APPENDIX A – DISTRIBUTION LIST

Federally Elected

Federal Courthouse, Ron Wyden, U.S. Senator, DC

Secretary of Housing and Urban Development, OK

U.S. House of Representatives, Jamie Herrera Beutler, The Honorable, DC

U.S. House, Dave Reichert, Representative, WA

U.S. House, Jaime Herrera Beutler, Representative, WA

U.S. House, Rick Larsen, Representative, WA

U.S. Senate, Jeff Merkley, Senator, OR

U.S. Senate, Maria Cantwell, Senator, DC

U.S. Senate, Maria Cantwell, Senator, DC

U.S. Senate, Patty Murray, Senator, DC

U.S. Senator Patty Murray, Mindi Linquist, Southwest Washington Director, WA

Federal Agencies

Acquisition Technology & Logistics, Peter Potochne, Acting Director, DC

Bureau of Land Management-OR State Office, John Styduhar, OR

Dept. of Commerce, Director, Ecology & Conservation, NOAA, DC

Dept. of Transportation - Office of Pipeline Safety, Harold Winnie, MO

Energy Facility Site Evaluation Council, Jim Luce, Chair, WA

Fed. Aviation Administration, Matthew McMillen, Office of Environment and Energy, DC

Fed. Communications Commission, Aliza Katz, NEPA contact, DC

Fed. Highway Administration, Gerald Solomon, Director, DC

Fed. Maritime Commission, Karen Gregory, Asst. Secretary, DC

Federal Energy Reguatory Commission, Medha Kochhar, Project Manager, MD

Federal Trade Commission, Asst. General Counsel, DC

General Services Administration, Environmental Program Manager, DC

HUD - Housing and Urban Dev, CA

Minerals Management Service, James Bennett, Chief, Environmental Assessment Branch, VA

National Marine Fisheries Service, Ben Meyer, OR

National Marine Fisheries Service, Dr. Tom Sibley, Branch Chief-Northwest Region, WA

National Marine Fisheries Service, Matt Longenbaugh, Branch Chief-Central Puget Sound, WA

National Marine Fisheries Service, Scott Anderson, WA

National Marine Fisheries Service, Tom Hausmann, WA

National Marine Fisheries Service-Habitat Conserv Div, Michael Crouse, Asst. Regional Admin., OR

National Marine Fisheries Service-NW Region, Robert D. Lohn, Regional Administrator, WA

National Marine Fisheries Service-Office of Habitat Protection-SSMC 3, Marine Resource Habitat Specialist, MD

National Marine Fisheries Service-Oregon State Habitat Branch, Michael Tehan, Director, OR

National Marine Fisheries Service-Protected Resources Division, Donna Darm, Assist. Regional Admin, WA

National Park Service, Lewis and Clark National Historic Trail, NE

National Park Service-Pacific West Region, Susan Rosebrough, WA

National Science Foundation, Charisse Carney-Nunes, VA

Nuclear Reg. Commission, Osiris Siurano, Intergovernment Programs, DC

Office of Environment/Health, Department of State, DC

Office of Federal Activities - EPA, Ariel Rios, Acting Director, DC

Office of Pipeline Safety, Karen Butler, MO

Office of the Deputy Under Secretary of Defense, Robert Uhrich, Installations and Environment, DC

Office of the Judge Advocate General, U.S.Coast Guard Headquarters, DC

Office of the Under Secretary of Defense, IRM, DC

Securities & Exchange Commission, David LaRoche, Special Counsel, DC

Small Business Administration, Gary Fox, Asst. General Counsel, DC

U.S. Army Corps of Engineers, Office of the Chief of Army Engineers, DC

U.S. Army Corps of Engineers, Dominic Yballe, CENWP-OD-G, OR

U.S. Army Corps of Engineers, Jim Goudzwaard, Portland District, OR

U.S. Army Corps of Engineers, Judy Linton, Portland District, OR

U.S. Army Corps of Engineers, Olivia Romano, Project Manager, WA

U.S. Army Corps of Engineers, Richard Chong, OR

U.S. Army Corps of Engineers-Portland District, Marci Johnson, Planning and Outreach Specialist, OR

U.S. Army Corps of Engineers-Seattle Dist., Peter Olmstead, SW WA Field Office, WA

U.S. Bureau of Indian Affairs, Northwest Regional Office, OR

U.S. Coast Guard Sector Portland, Russell Berg, OR

U.S. Coast Guard, WA

U.S. Coast Guard, Daniel LeBlanc, OR

U.S. Coast Guard, Jack Hug, Chief, Environmental Law Branch, CA

U.S. Coast Guard, Pacific Region, Dave Sox, Sr. Environmental Protection Specialist, CA

U.S. Coast Guard, Patrick Gerrity, Commander, Sector Portland, OR

Federal Agencies (cont'd)

U.S. Coast Guard-Office of Operating & Environmental Standards, Capt. Mike Blair, (CG-3PSO), DC

U.S. Dept. of Agriculture, Natural Resources Conservation Service, WA

U.S. Dept. of Agriculture, Office of Finance & Management, DC

U.S. Dept. of Agriculture, Linda Goodman, Forest Service - Pacific NW Region, Regional Forester, OR

U.S. Dept. of Commerce, NOAA, Director of Ecology & Conservation, DC

U.S. Dept. of Commerce, Office of the Secretary, Senior Policy Advisor, DC

U.S. Dept. of Energy, Office of Intergov Affairs--DOE, DC

U.S. Dept. of Homeland Security, David Reese, Environmental Protection Specialist, DC

U.S. Dept. of Homeland Security-U.S. Coast Guard, Chief, Port Security Branch, DC

U.S. Dept. of Housing & Urban Development, Office of Environment and Energy, Director, DC

U.S. Dept. of Labor, Mike O'Malley, Employment & Training, DC

U.S. Dept. of State, Office of Environment/Health, DC

U.S. Dept. of the Air Force, Environment & Safety, DC

U.S. Dept. of the Interior MIB 2340, Dir. Ofc. of Environmental Policy & Compliance, DC

U.S. Dept. of the Interior, Chip Jenkins, Deputy Regional Director, Pacific West Region, WA

U.S. Dept. of the Interior, Donald Sutherland, Bureau of Indian Affairs, NEPA Coordinator, DC

U.S. Dept. of the Interior, Elaine Brong, Bureau of Land Management, Oregon State Office, State Director, OR

U.S. Dept. of Transportation - Marine Safety Office, Daniel Pippenger, Commander, OR

U.S. Dept. of Transportation, Director - Environment and Policy, DC

U.S. Dept. of Transportation, Environmental Policies, DC

U.S. Dept. of Transportation, Pipeline & Hazardous Materials Safety Administration, DC

U.S. Dept. of Transportation, Pipeline & HazMat Safety Admin, DC

U.S. Dept. of Transportation, Office of Pipeline Safety, Administrator, Research & Special Programs, DC

U.S. Dept. of Transportation, Chris Hoidal, Western Office OPS/RSPA, Director, CO

U.S. Dept. of Transportation, Ellen Crum, Air Traffic Control Specialist, DC

U.S. Dept. of Transportation, Kenneth Lee, Director of Engineering and Research Division Office of Pipeline Safety, DC

U.S. Dept. of Transportation, Thomas Finch, CATS Manager, Western Region, PHMSA, CO

U.S. Dept. of Transportaton - Office of Pipeline Safety, Research and Research Programs Admin., GA

U.S. Environmental Protection Agency, Anthony Barber, Oregon Operations Office, Director, OR

U.S. Environmental Protection Agency, Christine Reichgott, Manager, NEPA Review, WA

U.S. Environmental Protection Agency, Teresa Kubo, OR

U.S. Environmental Protection Agency, Yvonne Vallette, Oregon Operations Office, Aquatic Ecologist, OR

U.S. Fish and Wildlife Service, Doug Young, Energy Program Coordinator, OR

U.S. Fish and Wildlife Service, Greg Smith, Oregon Fish & Wildlife Office, OR

U.S. Fish and Wildlife Service, Karen Myers, Biologist, WA

U.S. Fish and Wildlife Service, Kemper McMaster, Oregon Fish & Wildlife Office, State Supervisor, OR

U.S. Fish and Wildlife Service, Lisa Wood, WA

U.S. Fish and Wildlife Service, Martha Jensen, Branch Manager-Division of Consultation and Technical Assistance, WA

U.S. Fish and Wildlife Service, Rebecca Toland, Oregon Fish & Wildlife Office, OR

U.S. Forest Service, Ecosystem Mgmt. Coordination, DC

U.S. National Parks, Columbia Cascades Land Resources Program, WA

USDA Natural Resource Conservation Service, OR

USDA Forest Service, Jim Sauser, OR

State Representatives – Oregon

District 8 - OR, Paul Holvey, State Representative, OR

OR Governor, Kate Brown, OR

OR House of Representatives (Clatsop and Columbia Counties), Bradley Witt, OR

OR House of Representatives, Arnie Roblan, Co-Speaker of the House, OR

OR House of Representatives, Betty Komp, Representative, OR

OR House of Representatives, Bruce Hanna, Co-Speaker of the House, OR

OR House of Representatives, Deborah Boone, Representative, OR

OR House of Representatives, Kim Thatcher, Representative, OR

OR House of Representatives, Vic Gilliam, Representative, OR

OR State Senate, Betsy Johnson, Senator, OR

OR State Senate, Bruce Starr, Senator, OR

OR State Senate, Larry George, Senator, OR

OR State Senate, Lee Beyer, Senator, OR

OR State Senate, Peter Courtney, Senator, OR

State Representatives – Washington

State of Washington Senate (Wahkiakum Cty), Brian Hatfield, The Honorable, WA

State Representative - District 49, Nancy DeLeo, WA

WA House of Representatives, Brian Blake, State Representative, WA

WA House of Representatives, Dean Takko, State Representative, WA

WA House of Representatives, Jim Moeller, Representative, WA

State Representatives – Washington (cont'd)

Washington State Legislature, Andy Hill, Senator, WA

Washington State Legislature, Ann Rivers, Representative, WA

Washington State Legislature, Barbara Bailey, Representative, WA

Washington State Legislature, Bruce Dammeier, Representative, WA

Washington State Legislature, Cathy Dahlquist, Representative, WA

Washington State Legislature, Charles Ross, Representative, WA

Washington State Legislature, Christopher Hurst, Representative, WA

Washington State Legislature, Curtis King, Senator, WA

Washington State Legislature, Dan Kristiansen, Representative, WA

Washington State Legislature, Derek Stanford, Representative, WA

Washington State Legislature, Don Benton, Senator, WA

Washington State Legislature, Doug Ericksen, Senator, WA

Washington State Legislature, Ed Orcutt, Representative, WA

Washington State Legislature, Graham Hunt, Representative, WA

Washington State Legislature, Hans Dunshee, Representative, WA

Washington State Legislature, Hans Zeiger, Representative, WA

Washington State Legislature, J.T. Wilcox, Representative, WA

Washington State Legislature, Jason Overstreet, Representative, WA

Washington State Legislature, Jay Rodne, Representative, WA

Washington State Legislature, Joe Fain, Senator, WA

Washington State Legislature, Judy Clibborn, Representative, WA

Washington State Legislature, Kirk Pearson, Representative, WA

Washington State Legislature, Larry Springer, Representative, WA

Washington State Legislature, Luis Moscoso, Representative, WA

Washington State Legislature, Mark Hargrove, Representative, WA

Washington State Legislature, Mark Harmsworth, Representative, WA

Washington State Legislature, Maureen Walsh, Representative, WA

Washington State Legislature, Mike Hewitt, Senator, WA

Washington State Legislature, Norm Johnson, Representative, WA

Washington State Legislature, Norma Smith, Representative, WA

Washington State Legislature, Pam Roach, Senator, WA

Washington State Legislature, Pat Sullivan, Representative, WA

Washington State Legislature, Paul Harris, Representative, WA

Washington State Legislature, Randi Becker, Senator, WA

Washington State Legislature, Richard DeBolt, Representative, WA

Washington State Legislature, Rodne Jay, Representative, WA

Washington State Legislature, Roger Goodman, Representative, WA

Washington State Legislature, Rosemary McAuliffe, Senator, WA

Washington State Legislature, Steve Conway, Senator, WA

Washington State Legislature, Steve Hobbs, Senator, WA

Washington State Legislature, Steve Kirby, Representative, WA

Washington State Legislature, Steve Litzow, Senator, WA

Washington State Legislature, Steve O'Ban, Senator, WA

Washington State Legislature, Tami Green, Representative, WA

Washington State Legislature, Tana Senn, Representative, WA

Washington State Legislature, Terry Nealey, Representative, WA

Washington State Legislature, Vincent Buys, Representative, WA

State Government Agencies – Oregon

Columbia SWCD, OR

Governor's Office, Margi Hoggmann, Energy Policy Advisor, OR

Legislative Commission on Indian Services, Jeana Harrington, Commission Assistant, OR

Legislative Commission on Indian Services, Karen Quigley, Executive Director, OR

Northwest Clean Air Agency, Erica Shuler, WA

ODFW North Coast Watershed District, Chris Knutsen, District Fish Biologist, OR

Office of the State Fire Marshall, Stacy Warner, OR

OR Building Codes Agency, Dana Roberts, OR

OR Dept. of Agriculture, Bob Meinke, OR

OR Dept. of Agriculture, Deb Cannon, Food Division, OR

OR Dept. of Agriculture, Debbie Gorham, Administrator, OR

OR Dept. of Agriculture, Jim Johnson, Land Use & Water Planning Coord., OR

OR Dept. of Aviation, Jeff Caines, Aviation Planner, OR

OR Dept. of Energy, Adam Bless, OR

OR Dept. of Energy, Deanna Henry, Emergency Preparedness Manager, OR

OR Dept. of Energy, Diana Enright, Assistant Director Renewable Energy Public Information, OR

OR Dept. of Energy, Ken Niles, Nuclear Safety & Energy Siting, OR

OR Dept. of Energy, Michael Grainey, Director, OR

State Government Agencies – Oregon (cont'd)

OR Dept. of Energy, Tom Stoops, Siting Manager, OR

OR Dept. of Environmental Quality, Warrenton NWR Office, OR

OR Dept. of Environmental Quality, Christine Svetkovich, OR

OR Dept. of Environmental Quality, Jennifer Purcell, DEQ NW Region, OR

OR Dept. of Environmental Quality, L. Alexandra Cyril, 401 Water Quality Certification Specalist, OR

OR Dept. of Environmental Quality, Neil Mullane, OR

OR Dept. of Environmental Quality, NWR Storm Water, Dennis Jurries, OR

OR Dept. of Fish & Wildlife, Art Martin, OR

OR Dept. of Fish & Wildlife, Devin Simmons, OR

OR Dept. of Fish & Wildlife, Herman Biederbeck, OR

OR Dept. of Fish & Wildlife, Jon Germond, OR

OR Dept. of Fish & Wildlife, Keith Braun, Biologist, OR

OR Dept. of Fish & Wildlife, Rose Owens, Habitat Special Projects Coordinator, OR

OR Dept. of Fish & Wildlife, Tom Murtaugh, District Fish Biologist, OR

OR Dept. of Fish & Wildlife, Tom Rein, OR

OR Dept. of Fish & Wildlife, Wayne van der Naald, OR

OR Dept. of Forestry, OR

OR Dept. of Forestry, Dan Goody, Tillamook District Forester, OR

OR Dept. of Forestry, Forest Grove District, Mike Caferrata, District Forester, OR

OR Dept. of Forestry, George Pointe, OR

OR Dept. of Forestry, Joe Misek, OR

OR Dept. of Forestry, John Tokarczyk, OR

OR Dept. of Forestry, Ted Lorensen, Assistant State Forester, OR

OR Dept. of Forestry, Todd Reinwald, State Forest Planning Coordinator, OR

OR Dept. of Forestry, Tom Savage, District Forester, OR

OR Dept. of Forestry: Astoria Dist., Cullen Bangs, OR

OR Dept. of Geology & Mineral Industries, OR

OR Dept. of Geology & Mineral Industries, Bill Burns, Engineering Geologist, OR

OR Dept. of Geology & Mineral Industries, Dr. Vicki McConnell, OR

OR Dept. of Highways, OR

OR Dept. of Justice, Anika Marriott, OR

OR Dept. of Justice, Lore Bensel, OR

OR Dept. of Justice, Paul Garrahan, OR

OR Dept. of Justice, Stephen Sanders, OR

OR Dept. of Justice, Steve Shipsey, OR

OR Dept. of State Lands, Ann Hanus, Director, OR

OR Dept. of State Lands, Clara Taylor, Waterway Lease Agent, OR

OR Dept. of State Lands, Janet Morlan, OR

OR Dept. of State Lands, Jim Grimes, OR

OR Dept. of State Lands, Kevin Moynahan, OR

OR Dept. of State Lands, Lori Warner-Dickason, OR

OR Dept. of State Lands, Louise Bos, OR

OR Dept. of State Lands, Louise Solliday, Director, OR

OR Dept. of Transportation Dist. 2A, Ron Kroop, OR

OR Dept. of Transportation, OR

OR Dept. of Transportation, OR

OR Dept. of Transportation, District Manager - District 1 Maintenance, OR

OR Dept. of Transportation, David J. Neys, District Manager - District 1 Maintenance, OR

OR Dept. of Transportation, Donald L. Jordan, OR

OR Dept. of Transportation, Edward Miller, OR

OR Dept. of Transportation, Ingrid Weisenbach, OR

OR Dept. of Transportation, Kelvin Kohanes, OR

OR Dept. of Transportation, Matt Caswell, OR

OR Dept. of Veteran Affairs, OR

OR Economic & Community Development Commission, Carl Talton, Commissioner, OR

OR Economic & Community Development Commission, Marty Brantely, Director, OR

OR Economic & Community Development Commission, Ron Fox, OR

OR Economic & Community Development Commission, Tony Hyde, Commissioner, OR

OR Governor's Office, Mike Carrier, Natural Resources Policy Director, OR

OR Historical Society, George L Vogt, Executive Director, OR

OR Invasive Species Council, Plant Division C/O Oregon Dept. of Agriculture, OR

OR Natural Resources Council, Regna Merritt, Executive Director, OR

OR Parks & Rec Dept., State Historic Preservation Office, Dr. Dennis Griffin, OR

OR Parks & Rec Dept., State Historic Preservation Office, Jason Allen, OR

OR Parks & Rec Dept., State Historic Preservation Office, Matthew Diederich, OR

OR Parks & Rec Dept., Steve Brutscher, OR

OR Public Utility Commission, Kenneth R. Zimmerman, Senior Analyst - Electric and Natural Gas Division, OR

OR Public Utility Commission, Lee Beyer, OR

OR State Board of Forestry, OR

OR State Fire Marshall, OR

OR State Marine Board, Randy Henry, OR

OR Water Resources Dept., Dwight French, OR

OR Water Resources Dept., Jerry Sauter, OR

Oregon State Habitat Office, Kim W. Kratz, Director, WA

Dept. of Community, Trade & Economic Dev, Allen Fiksdal, Manager, Energy, Facility, WA

Dept. of Community, Trade & Economic Dev, Stephen Posner, EFSEC Specialist, Energy Facility, WA

State Government Agencies – Washington

Dept. of Community, Trade & Economic Dev, Tony Usibelli, Assistant Director Energy Policy Division, WA

Energy Facility Site Evaluation Council, Al Wright, Manager, Energy Facility, WA

Governor's Office of Regulatory Assistance, Alan Bogner, SW Region Lead, WA

Governor's Office of Regulatory Assistance, Jane Dewell, Regional Lead, WA

Northwest Clean Air Agency, Christoforou Christos, Air Quality Engineer, WA

Northwest Clean Air Agency, Christos Christoforou, Air Quality Engineer, WA

Northwest Clean Air Agency, Erica Shuhler, Air Quality Engineer, WA

Office of Regulatory Assistance, Karen Pemerl, Director, WA

Office of the Governor, Joby Shimomura, Chief of Staff, WA

Puget Sound Clear Air Agency, Gerry Pade, Air Quality Engineer, WA

Southwest Clean Air Agency, Vannessa McClelland, Air Quality Engineer, WA

State Historic Preservation Office, Dr. Robert Whitlam, State Archaeologist, WA

State of Washington, WA

State of Washington, Paul L & Karen J Johansen, WA

State School Land, WA

WA Dept. of Commerce, Brian Bonlender, Director, WA

WA Dept. of Ecology, Brenden McFarland, Manager, Shorelands and Environmental Assistance (HQ), WA

WA Dept. of Ecology, Helen Pressley, Shorelands & Environmental Assistance, WA

WA Dept. of Ecology, Jeanie Summerhays, Shorelands & Environmental Assistance, WA

WA Dept. of Ecology, Lori Ochoa, Federal Permit Coordinator, SW Region, WA

WA Dept. of Ecology, Marc Crooks, WA

WA Dept. of Ecology, Paula Ehlers, WA

WA Dept. of Ecology, Perry Lund, WA

WA Dept. of Ecology, Rebecca Schroeder, WA

WA Dept. of Ecology, Rebekah Padgett, Federal Permit Coordinator, NW Region, WA

WA Dept. of Ecology, Ryan Paulsen, WA

WA Dept. of Ecology, Sally Toteff, Director SW Regional Office, WA

WA Dept. of Ecology, Terry Swanson, WA

WA Dept. of Fish and Wildlife - Southwest Region 5, Tim Rymer, Regional Habitat Program Manager, WA

WA Dept. of Fish and Wildlife, Anne Friesz, Assistant Regional Habitat Program Manager, WA

WA Dept. of Fish and Wildlife, Brock Applegate, Major Projects Mitigation Biologist, WA

WA Dept. of Fish and Wildlife, Dave Howe, Program Manager, Region 5, WA

WA Dept. of Fish and Wildlife, Joel Ingram, WA

WA Dept. of Fish and Wildlife, Leonard Machut, WA

WA Dept. of Fish and Wildlife, Region 5, Steve West, Area Habitat Biologist, WA

WA Dept. of Fish and Wildlife, Stephan Kalinowski, Program Manager, WA

WA Dept. of Fish and Wildlife, Wendy Cole, WA

WA Dept. of Natural Resources - Aquatic Region Rivers District, Scott Robinson, WA

WA Dept. of Natural Resources - Aquatic Resources Division, Courtney Wasson, DMMP Manager, WA

WA Dept. of Natural Resources, Art Tasker, Region Manager, WA

WA Dept. of Natural Resources, Ben Cleveland, Region Manager, WA

WA Dept. of Natural Resources, Curt Pavola, WA

WA Dept. of Natural Resources, Darin Cramer, Division Manager, WA

WA Dept. of Natural Resources, Dennis Clark, WA

WA Dept. of Natural Resources, Eric Wilsch, Region Manager, WA

WA Dept. of Natural Resources, Kristin Swenddal, WA

WA Dept. of Natural Resources, WA

WA Dept. of Transportation, WA

WA Dept. of Transportation, Jeff Barsness, Southwest Region Development Services Manager, WA

Washington Governor, Jay Inslee, Governor, WA

Washington Governor's Office, Office of the Governor, WA

Washington State Conservation Commission, WA

Washington State Department of Agriculture, Dan Newhouse, Director, WA

Washington State Department of Game, WA

Washington State Forest Board, WA

Washington State Noxious Weed Control Board, WA

Washington Utilities Transportation Commission, David Lykken, Pipeline Safety Director, WA

Washington Utilities Transportation Commission, Jeffrey Goltz, Chair, WA

Washington Utilities Transportation Commission, Joe Subsits, Pipeline Safety Program, WA

Washington Utilities Transportation Commission, Patrick Oshie, Commissioner, WA

Washington Utilities Transportation Commission, Phil Jones, Commissioner, WA

Washington, State of, Pierce College, WA

Local Government Agenies – Oregon

City of Astoria, Arline LaMear, Councilor, OR

City of Astoria, John Compere, Community Liaison, OR

City of Astoria, Karen Mellin, Councilor, OR

City of Astoria, Peter Roscoe, Councilor, OR

City of Astoria, Russ Warr, Councilor, OR

City of Astoria, Willis VanDusen, Mayor, OR

City of Banks, Brian Biehl, Councilor, OR

City of Banks, Craig Stewart, Councilor, OR

City of Banks, Jason Short, Councilor, OR

Local Government Agenies – Oregon (cont'd)

City of Banks, Pete Edison, Councilor, OR

City of Banks, Ron Kemper, Councilor, OR

City of Banks, Teri Branstitre, Mayor, OR

City of Carlton, Carey Rhoads, Councilor, OR

City of Carlton, David Vandewalle, Councilor, OR

City of Carlton, Ginger Williams, Councilor, OR

City of Carlton, Jesse Berry, Councilor, OR

City of Carlton, Kathie Oriet, Mayor, OR

City of Carlton, Scott Carl, Councilor, OR

City of Carlton, Steven Weaver, City Manager, OR

City of Cornelius, Brad Coffey, Councilor, OR

City of Cornelius, David Waffle, City Manager, OR

City of Cornelius, Jeffrey Dalin, Councilor, OR

City of Cornelius, Neal Knight, Mayor, OR

City of Cornelius, Robert Ferrie, Councilor, OR

City of Cornelius, Steve Heinrich, Councilor, OR

City of Dayton, Jolie White, Mayor, OR

City of Dayton, Monte Blackburn, Councilor, OR

City of Dayton, Sue Hollis, City Manager, OR

City of Forest Grove, Camille Miller, Councilor, OR

City of Forest Grove, Elena Uhing, Councilor, OR

City of Forest Grove, Michael Sykes, City Manager, OR

City of Forest Grove, Pete Truax, Councilor, OR

City of Forest Grove, Richard Kidd, Mayor, OR

City of Forest Grove, Ron Thompson, Councilor, OR

City of Forest Grove, Tom Johnston, Councilor, OR

City of Forest Grove, Victoria Lowe, Councilor, OR

City of Gaston, Dwain McKenzie, Councilor, OR

City of Gaston, Ed Schult, Councilor, OR

City of Gaston, Grace Haines-Kloock, Councilor, OR

City of Gaston, Jon Georg, Councilor, OR

City of Gaston, Richard Sager, Councilor, OR

City of Gaston, Rick Lorenz, Mayor, OR

City of Gearhart, Carole Connell, City Planner, OR

City of Gearhart, Chuck Schluter, Councilor, OR

City of Gearhart, Dennis McNally, Councilor, OR

City of Gearhart, Dianne Widdop, Councilor, OR

City of Gearhart, Dorothy Well, Councilor, OR

City of Gearhart, Ed Tice, Councilor, OR

City of Gearhart, Kent Smith, Mayor, OR

City of Gearhart, Lauren Schibye, Student Representative, OR

City of Gervais, John Harvey, Council President, OR

City of Gervais, Michael Gregory, Councilor, OR

City of Gervais, Pamela Milam, Councilor, OR

City of Gervais, Sam Sasaki, City Manager, OR

City of Gervais, Sandra Foote, Councilor, OR

City of Gervais, Shanti Platt, City Mayor, OR

City of Gervais, Tony Miller, Councilor, OR

City of Hubbard, Angie Wheatcroft, Councilor, OR

City of Hubbard, Bruce Warner, Councilor, OR

City of Hubbard, Chip Enbody, Councilor, OR

City of Hubbard, Matt Kennedy, Councilor, OR

City of Hubbard, Mike Hill, Planning Commission Chair, OR

City of Hubbard, Tom McCain, Mayor, OR

City of Lafayette, Art Bixman, Councilor, OR

City of Lafayette, Bob Cullen, Councilor, OR

City of Lafayette, Diane Rinks, City Administrator, OR

City of Lafayette, Don Leard, Mayor, OR

City of Lafayette, James Rue, Councilor, OR

City of Lafayette, Lisa Heatherly, Councilor, OR

City of Lafayette, Matt Smith, Councilor, OR

City of Lafayette, Michael Roberts, Councilor, OR

City of McMinnville, Dave Hansen, Councilor, OR

City of McMinnville, Ed Gormley, Mayor, OR

City of McMinnville, Kellie Menke, Councilor, OR

City of McMinnville, Kent Taylor, City Manager, OR

City of McMinnville, Larry Yoder, Councilor, OR

City of McMinnville, Paul May, Councilor, OR

City of McMinnville, Rick Olson, Councilor, OR

City of McMinnville, Scott Hill, Councilor, OR

City of Molalla, Donna Jacober, City Council, OR

City of Molalla, Glen Boreth, City Council, OR

City of Molalla, James Needham, City Council, OR

City of Molalla, Mary Jo Mackie, City Council, OR

City of Molalla, Shane Potter, Planning Director, OR

City of Molalla, Tom Foster, Mayor, OR

City of Saint Paul, Charlie Bernards, Councilor, OR

City of Saint Paul, Jay Phillips, Councilor, OR

City of Saint Paul, Kathy Connor, Mayor, OR

City of Saint Paul, Kelly Fowler, Councilor, OR

City of Saint Paul, Mike Bernard, Councilor, OR

City of Saint Paul, Walt Wendolowski, City Planner, OR

City of Seaside, Dave Moore, Councilor, OR

City of Seaside, Don Johnson, Councilor, OR

City of Seaside, Don Larson, Mayor, OR

City of Seaside, Gary Diebold, Councilor, OR

City of Seaside, Kevin Cupples, City Planner, OR

City of Seaside, Larry Haller, Councilor, OR

City of Seaside, Mark Winstanley, City Manager, OR

City of Seaside, Stubby Lyons, Councilor, OR

City of Seaside, Tim Tolan, Councilor, OR

City of St. Helens, Randy Peterson, Mayor and Interim City Administrator, OR

City of Warrenton, OR

City of Warrenton, Bob Maxfield, City Manager, OR

Local Government Agenies – Oregon (cont'd)

City of Warrenton, Carol Parker, City Planner, OR

City of Warrenton, Dick Hellberg, OR

City of Warrenton, Don Snyder, Public Works Director, OR

City of Warrenton, Edward Madere, City Manager, OR

City of Warrenton, Frank Orrell, City Council, OR

City of Warrenton, James (Lessee) Scarborough, OR

City of Warrenton, Mark Kujala, Mayor, OR

City of Warrenton, Russ Farmer, OR

City of Warrenton, Skip Urling, Community Development Director, OR

City of Warrenton, Ted Ames, Fire Chief, OR

City of Warrenton, Terry Ferguson, City Council, OR

City of Woodburn, City Council, OR

City of Woodburn, City Planner, OR

City of Woodburn, John Brown, City Administrator, OR

City of Woodburn, Kathy Figley, Mayor, OR

City of Yamhill, Kay Echauri, Councilor, OR

City of Yamhill, Melvin Jordan, Council President, OR

City of Yamhill, Paula Terp, Councilor, OR

City of Yamhill, Randy Murphy, Mayor, OR

City of Yamhill, Senz Chris, Councilor, OR

Clackamas County, Martha Schrader, Commissioner, OR

Clatsop County Board of Commissioners, Peter Huhtala, Chairperson, OR

Clatsop County Farm Bureau, Mike Seppa, OR

Clatsop County Planning Dept., Kathleen Sellman, CDD Director, OR

Clatsop County, Ann Samuelson, Commissioner, OR

Clatsop County, Helen Westbrook, Commissioner, OR

Clatsop County, Hiller West, Director, Land Use Planning, OR

Clatsop County, Jeff Hazen, Commissioner, OR

Clatsop County, Jennifer Bunch, OR

Clatsop County, Lyla Gaebel, Commissioner, OR

Clatsop County, Patricia Roberts, Commissioner, OR

Clatsop County, Richard Lee, Commissioner, OR

Clatsop County, Samuel Patrick, Commissioner, OR

Clatsop Soil & Water Conservation District, Misty Ogier, OR

Columbia County, Joe Corsiglia, Commissioner, OR

Columbia County, Rita Bernhard, Commissioner, OR

Columbia County, Todd Dugdale, Land Development Services Director, OR

Columbia County, Tony Hyde, Commissioner, OR

Columbia River Estuary Study Taskforce, Denise Lofman, Director, OR

Columbia River PUD, OR

Marion County Farm Bureau, Dan Goffin, President, OR

Marion County, Janet Carlson, Commissioner, OR

Marion County, Patti Milne, Commissioner, OR

Marion County, Sam Brentano, Commissioner, OR

Tillamook County, Brad Sheets, Associate Planner, OR

Tillamook County, Mark Labhart, Commissioner, OR

Tillamook County, Tim Josi, Commissioner, OR

Tualatin Soil & Water Conservation District Board, Jerry Ward, Chair, OR

Washington County, Andy Duyck, Commissioner, OR

Washington County, Dick Schouten, Commissioner, OR

Washington County, Roy Rogers, Commissioner, OR

Washington County, Terry Lawler, OR

Washington County, Tom Brian, Commissioner, OR

Yamhill County, Kathy George, Commissioner, OR

Yamhill County, Leslie Lewis, Commissioner, OR

Yamhill County, Mary Stern, Commissioner, OR

Local Government Agenies – Washington

City of Auburn, Bill Peloza, Councilor, WA

City of Auburn, Bob Lee, Police Chief, WA

City of Auburn, Chris Andersen, WA

City of Auburn, Claude DaCorsi, Councilor, WA

City of Auburn, Daniel B. Heid, City Attorney, WA

City of Auburn, Daryl Faber, Parks & Recreation, WA

City of Auburn, Jeff Tate, Assistant Director, Community Development, WA

City of Auburn, John Holman, Councilor, WA

City of Auburn, Kevin Snyder, Public Works Director, WA

City of Auburn, Largo Wales, Councilor, WA

City of Auburn, Nancy Backus, Mayor, WA

City of Auburn, Nancy Welch, Director of Planning, WA

City of Auburn, Richard Wagner, Deputy Mayor, WA

City of Auburn, Wayne Osborne, Councilor, WA

City of Auburn, Yolanda Trout, Councilor, WA

City of Bellingham, Cathy Lehman, Councilor, WA

City of Bellingham, Gene Knutson, Councilor, WA

City of Bellingham, Jack Weiss, Councilor, WA

City of Bellingham, James King, Parks & Recreation Director, WA

City of Bellingham, Jeff Thomas, Planning Director, WA

City of Bellingham, Kelli Linville, Mayor, WA

City of Bellingham, Mark Gill, Interim Police Chief, WA

City of Bellingham, Michael Lilliquist, Councilor, WA

City of Bellingham, Peter Raffato, City Attorney, WA

City of Bellingham, Pinky Vargas, Councilor, WA

City of Bellingham, Roger Christensen, Fire Chief, WA

City of Bellingham, Roxanne Murphy, Councilor, WA

City of Bellingham, Ted Carlson, Public Works Director, WA

City of Bellingham, Terry Bornemann, Councilor, WA

City of Bonney Lake, Dan Grisby, Public Works Director, WA

City of Bonney Lake, Dan Morrison, City Administrator, WA

City of Bonney Lake, Dan Swatman, Councilor, WA

City of Bonney Lake, Dana Powers, Police Chief, WA

Local Government Agenies – Washington (cont'd)

City of Bonney Lake, Donn Lewis, Councilor, WA

City of Bonney Lake, James Rackley, Councilor, WA

City of Bonney Lake, Jason Sullivan, Senior Planner, WA

City of Bonney Lake, John Vodopich, Community Development Dir., WA

City of Bonney Lake, Katrina Minton-Davis, Councilor, WA

City of Bonney Lake, Mark Hamilton, Councilor, WA

City of Bonney Lake, Neil Johnson, Mayor, WA

City of Bonney Lake, Randy McKibbin, Councilor, WA

City of Bonney Lake, Tom Watson, Councilor, WA

City of Burlingon, Bill Van Wieringen, Police Chief, WA

City of Burlington, Bill Aslett, Councilor, WA

City of Burlington, Chris Loving, Councilor, WA

City of Burlington, Dave Nielson, Fire Chief, WA

City of Burlington, Edie Edmundson, Councilor, WA

City of Burlington, Garnor Bensen, Councilor, WA

City of Burlington, Margaret Fleek, Planning Director, WA

City of Burlington, Mary Pulst P.E.,, Public Works Director, WA

City of Burlington, Rick DeGloria, Councilor, WA

City of Burlington, Steve Sexton, Mayor, WA

City of Burlington, Ted Montgomery, Councilor, WA

City of Burlington, Tonya Bieche, Councilor, WA

City of Castle Rock, Bob Heuer, Police Chief, WA

City of Castle Rock, David Vorse, Public Works Director, WA

City of Castle Rock, Earl Queen, Councilor, WA

City of Castle Rock, Ellen Rose, Councilor, WA

City of Castle Rock, Glenn Pingree, Councilor, WA

City of Castle Rock, Mike Davis, Councilor, WA

City of Castle Rock, Paul Helenberg, Mayor, WA

City of Castle Rock, Ray Teter, Councilor, WA

City of Castle Rock, T.J. Keiran, City Planner, WA

City of Centralia, Bart Ricks, Councilor, WA

City of Centralia, Bonnie Canaday, Councilor, WA

City of Centralia, Emil Pierson, Community Development Director, WA

City of Centralia, Gabe Anzelini, Councilor, WA

City of Centralia, Harlan Thompson, Mayor, WA

City of Centralia, Jim Walkowski, Fire Chief, WA

City of Centralia, John Elmore, Councilor, WA

City of Centralia, Kahle Jennings, Public Works Director, WA

City of Centralia, Lee Coumbs, Councilor, WA

City of Centralia, Patrick Gallgher, Councilor, WA

City of Centralia, Rob Hill, City Manager, WA

City of Centralia, Robert Berg, Police Chief, WA

City of Centralia, Ron Greenwood, Councilor, WA

City of Centralia, Shannon Murphy, City Attorney, WA

City of Centralia, Tammy Baraconi, Planning Director, WA

City of Chehalis, Anthony Ketchum, Mayor, WA

City of Chehalis, Chad Taylor, Councilor, WA

City of Chehalis, Daryl Lund, Councilor, WA

City of Chehalis, Dennis Dawes, Councilor, WA

City of Chehalis, Dennis Osborne, Community Development Dir., WA

City of Chehalis, Glenn Schaffer, Police Chief, WA

City of Chehalis, Issac Pope, Councilor, WA

City of Chehalis, Jim Walkowski, Fire Chief, WA

City of Chehalis, Merlin MacReynold, City Manager, WA

City of Chehalis, Rick Sahlin, Public Works Director, WA

City of Chehalis, Robert Spahr, Councilor, WA

City of Chehalis, Terry Harris, Mayor Pro-Tem, WA

City of Chehalis, William Hillier, City Attorney, WA

City of Covington, Derek M. Matheson, City Manager, WA

City of Covington, Don Vondran, Public Works Director, WA

City of Covington, James Scott, Councilor, WA

City of Covington, Jeff Wagner, Mayor Pro-Tem.Councilor, WA

City of Covington, Joseph Cimaomo Jr., Councilor, WA

City of Covington, Kevin Klason, Police Chief, WA

City of Covington, Margaret Harto, Mayor, WA

City of Covington, Mark Lanza, Councilor, WA

City of Covington, Marlla Mhoon, Councilor, WA

City of Covington, Nelson Ogren, WA

City of Covington, Richard Hart, Community Development Dir., WA

City of Covington, Salina Lyons, Principal Planner, WA

City of Covington, Scott Thomas, Parks & Recreation Director, WA

City of Covington, Wayne Snoey, Councilor, WA

City of Everett, WA

City of Everett, Allan Giffen, Planning Director, WA

City of Everett, Dave Davis, Public Works Director, WA

City of Everett, Kathy Atwood, Police Chief, WA

City of Everett, Murray Gordon, Fire Chief, WA

City of Everett, Paul Kaftanski, Parks Director, WA

City of Everett, Richard Anderson, Councilor, WA

City of Everson, Andy Jewell, Councilor, WA

City of Everson, Andy Rowlson, Councilor, WA

City of Everson, Dan MacPhee, Police Chief, WA

City of Everson, Eric Oettel, Councilor, WA

City of Everson, Jennifer Lautenbach, Councilor, WA

City of Everson, John Sitkin, City Attorney, WA

City of Everson, Rick Holt, Public Works Director, WA

City of Everson, Rollin Harper, Planning Director, WA

City of Granite Falls, Brent Kirk, Public Works Supervisor, WA

City of Granite Falls, Don Lauer, Acting Police Chief, WA

City of Granite Falls, Joshua Golston, Mayor, WA

City of Granite Falls, Matt Hartman, Councilor, WA

City of Granite Falls, Ray Sturtz, Planning Director, WA

Local Government Agenies – Washington (cont'd)

City of Granite Falls, Suzie Ashworth, Councilor, WA

City of Granite Falls, Tess Greene, Councilor, WA

City of Granite Falls, Thomas Fitzgerald, Councilor, WA

City of Granite Falls, Tom Collins, Councilor, WA

City of Ilawco, Flint Wright, Police Chief, WA

City of Ilawco, Tom Williams, Fire Chief, WA

City of Issaquah, WA

City of Issaquah, Anne McGill, Parks & Recreation Director, WA

City of Issaquah, Brenda Bramwell, Emergency Mgmt. Coordinator, WA

City of Issaquah, Charlie Bush, Deputy City Administrator, WA

City of Issaquah, Eileen Barber, Councilor, WA

City of Issaquah, Fred Butler, Mayor, WA

City of Issaquah, Jason Rogers, Developmental Services, WA

City of Issaquah, Joshua Schaer, Councilor, WA

City of Issaquah, Keith Niven, Economic Development Director, WA

City of Issaquah, Lee A. Soptich, Fire Chief, WA

City of Issaquah, Lynne Sheldon, Public Works Director, WA

City of Issaquah, Mark Hinthorne, Planning Director, WA

City of Issaquah, Mary Lou Pauly, Councilor, WA

City of Issaquah, Matt Mechler, Open Space Steward, WA

City of Issaquah, Nina Milligan, Councilor, WA

City of Issaquah, Paul Ayers, Chief of Police, WA

City of Issaquah, Paul Winterstein, Councilor, WA

City of Issaquah, Stacy Goodman, Councilor, WA

City of Issaquah, Tola Marts, Councilor, WA

City of Kalama, Adam Smee, City Administrator, WA

City of Kalama, Dominic Ciancibelli, Councilor, WA

City of Kalama, Donald Purvis, Mayor Pro-Tem, WA

City of Kalama, Mary Putka, Councilor, WA

City of Kalama, Matt Hermen, Planning Director, WA

City of Kalama, Mike Langham, Councilor, WA

City of Kalama, Mike Truesdell, Councilor, WA

City of Kalama, Paul Brachvogel, City Attorney, WA

City of Kalama, Pete Poulsen, Mayor, WA

City of Kalama, Randy Gibson, Police Chief, WA

City of Kelso, Andrew O. Hamilton, Police Chief, WA

City of Kelso, Dan Myers, Councilor, WA

City of Kelso, David Futcher, Mayor, WA

City of Kelso, Frank Randolph, City Attorney, WA

City of Kelso, Gary Archer, Councilor, WA

City of Kelso, Gary Schimmel, Councilor, WA

City of Kelso, Kim Lefebvre, Councilor, WA

City of Kelso, Michael Kardas, Community Development Dir., WA

City of Kelso, Rick Roberson, Councilor, WA

City of Kelso, Steve Taylor, City Manager, WA

City of Kelso, Todd McDaniel, Deputy Mayor, WA

City of Kent, Bill Boyce, Councilor, WA

City of Kent, Dana Ralph, Councilor, WA

City of Kent, Deborah Ranniger, Councilor, WA

City of Kent, Dennis Higgins, Councilor, WA

City of Kent, Fred Satterstrom, Planning Director, WA

City of Kent, Jim Berrios, Councilor, WA

City of Kent, Jim Schneider, Fire Chief, WA

City of Kent, John Hodgson, Chief Adminstrative Officer, WA

City of Kent, Kelly Peterson, AICP, Environmental Conservation Supervisor, WA

City of Kent, Ken Thomas, Police Chief, WA

City of Kent, Kurt Hanson, AICP, Economic Development Manager, WA

City of Kent, Les Thomas, Councilor, WA

City of Kent, Suzette Cooke, Mayor, WA

City of Kent, Tim LaPorte, Public Works Director, WA

City of Kent, Tom Brubaker, City Attorney, WA

City of Lake Stevens, Becky Ableman, Planning Director, WA

City of Lake Stevens, John Spencer, Councilor, WA

City of Lake Stevens, Kathy Holder, Councilor, WA

City of Lake Stevens, Kim Daughtry, Councilor, WA

City of Lake Stevens, Marcus Tageant, Councilor, WA

City of Lake Stevens, Mark Somers, Councilor, WA

City of Lake Stevens, Mike Monken, Public Works Director, WA

City of Lake Stevens, Randy Celori, Police Chief, WA

City of Lake Stevens, Sam Low, Councilor, WA

City of Lake Stevens, Suzanne Quigley, Councilor, WA

City of Lake Stevens, Vern Little, Mayor, WA

City of Longview, Bob Gregory, City Manager, WA

City of Maple Valley, Bill Allison, Mayor, WA

City of Maple Valley, Christy Todd, City Attorney, WA

City of Maple Valley, David Johnston, City Manager, WA

City of Maple Valley, Erin Weaver, Councilor, WA

City of Maple Valley, Greg Brown, Parks & Recreation Director, WA

City of Maple Valley, Layne Barnes, Councilor, WA

City of Maple Valley, Linda Johnson, Councilor, WA

City of Maple Valley, Matt Torpey, Senior Planner, WA

City of Maple Valley, Noel Gerken, Councilor, WA

City of Maple Valley, Sean Kelly, Deputy Mayor, WA

City of Maple Valley, Steve Clark, Public Works Director, WA

City of Maple Valley, Victoria Laise Jonas, Councilor, WA

City of Marysville, Donna Wright, Councilor, WA

City of Marysville, Gloria Hirashima, Community Development Dir., WA

City of Marysville, Jeff Seibert, Councilor, WA

City of Marysville, Jeffrey Vaughan, Mayor Pro Tem, WA

Local Government Agenies – Washington (cont'd)

City of Marysville, Jim Ballew, Parks & Recreation Director, WA

City of Marysville, Jon Nehring, Mayor, WA

City of Marysville, Kamille Norton, Councilor, WA

City of Marysville, Kevin Nielsen, Public Works Director, WA

City of Marysville, Michael Stevens, Councilor, WA

City of Marysville, Rick Smith, Police Chief, WA

City of Marysville, Roy Toyer, Councilor, WA

City of Marysville, Steven C. Muller, Councilor, WA

City of Monroe, Brad Feilberg, P.E., Public Works Director, WA

City of Monroe, Ed Davis, Councilor, WA

City of Monroe, Geoffrey Thomas, Mayor, WA

City of Monroe, Jamie Silva, Fire Chief, WA

City of Monroe, Jason Gamble, Councilor, WA

City of Monroe, Jeff Rasmussen, Councilor, WA

City of Monroe, Jim Kamp, Councilor, WA

City of Monroe, Kevin Hanford, Councilor, WA

City of Monroe, Kurt Goering, Councilor, WA

City of Monroe, Mike Farrell, Parks & Recreation Director, WA

City of Monroe, Patsy Cudaback, Councilor, WA

City of Monroe, Paul Popelka, RLA/AICP, Planning & Permitting Manager, WA

City of Monroe, T. Quenzer, Police Chief, WA

City of Mount Vernon, Bob Fiedler, Councilor, WA

City of Mount Vernon, Dale Ragan, Councilor, WA

City of Mount Vernon, Esco Bell P.E.,, Public Works Director, WA

City of Mount Vernon, Gary Molenaar, Councilor, WA

City of Mount Vernon, Jill Boudreau, Mayor, WA

City of Mount Vernon, Joe Lindquist, Councilor, WA

City of Mount Vernon, Ken Quam, Councilor, WA

City of Mount Vernon, Larry Otos, Parks & Recreation Director, WA

City of Mount Vernon, Mark Hulst, Councilor, WA

City of Mount Vernon, Mike Urban, Councilor, WA

City of Napavine, Jennifer Slemp, Councilor, WA

City of Napavine, John Sayers, Mayor, WA

City of Napavine, Kenneth Twining, Superintendent, WA

City of Napavine, LaVerne Haslett, Councilor, WA

City of Napavine, Lionel Pinn, Councilor, WA

City of Napavine, Robert A. Wheeler, Councilor, WA

City of Napavine, S. Elwood, Officer in Charge, WA

City of Napavine, Scott Hamilton, Councilor, WA

City of Napavine, Steve Ashley, Community Development Director, WA

City of Nooksack, Bruce Likkel, Public Works Director, WA

City of Nooksack, Daniel Bennett, Councilor, WA

City of Nooksack, Fritz Zemler, Councilor, WA

City of Nooksack, Jim Ackerman, Mayor, WA

City of Nooksack, Marshall Judy, Councilor, WA

City of Nooksack, Mel Blankers, Fire Chief, WA

City of Nooksack, Scott Bodven, Councilor, WA

City of Nooksack, Tom Fryer, City Attorney, WA

City of Nooksack, Tom Jones, Councilor, WA

City of Puyallup, Brian Jeter, Police Chief, WA

City of Puyallup, Dan Handa, Public Park, WA

City of Puyallup, Heather Shadko, Councilor, WA

City of Puyallup, John D. Knutsen, Deputy Mayor, WA

City of Puyallup, John Hopkins, Councilor, WA

City of Puyallup, John Palmer, Councilor, WA

City of Puyallup, Julie Door, Councilor, WA

City of Puyallup, Kevin Yamato, City Attorney, WA

City of Puyallup, Rick Hansen, Councilor, WA

City of Puyallup, Rob Andreotti, Public Works Director, WA

City of Puyallup, Sarah Harris, Parks Administrator, WA

City of Puyallup, Steve Vermillion, Councilor, WA

City of Puyallup, Tom Swanson, Councilor, WA

City of Puyallup, Tom Utterback, Planning Director, WA

City of Puyallup, William McDonald, City Manager, WA

City of Rainier, Fire Chief, WA

City of Rainier, Bob Shaw, Councilor, WA

City of Rainier, Christine Winslow, Councilor, WA

City of Rainier, Dennis McVey, Councilor, WA

City of Rainier, Fred Evander, Planning Director, WA

City of Rainier, Kristin Guizzetti, Councilor, WA

City of Rainier, Randy Schleis, Mayor, WA

City of Rainier, Ronald Gibson, Public Works Director, WA

City of Rainier, Tom Ambrister, Councilor, WA

City of Rainier, William Cameron, City Attorney, WA

City of Sammamish Finance Dept, Jeff Brauns, City Engineer, WA

City of Sammamish, Ben Yazici, City Manager, WA

City of Sammamish, Bob Keller, Councilor, WA

City of Sammamish, Darci Donovan, Permit Manager, WA

City of Sammamish, Don Gerend, Councilor, WA

City of Sammamish, Jessi Bon, Parks & Recreation Director, WA

City of Sammamish, Kamuron Gurol, Planning Director, WA

City of Sammamish, Kathy Huckabay, Councilor, WA

City of Sammamish, Laura Philpot, Public Works Director, WA

City of Sammamish, Linda Frkuska, Parks & Recreation Deputy Director, WA

City of Sammamish, Nancy Whitten, Councilor, WA

City of Sammamish, Nate Elledge, Police Chief, WA

City of Sammamish, Ramiro Valderrama- Aramayo, Councilor, WA

City of Sammamish, Tom Odell, Mayor, WA

Local Government Agenies – Washington (cont'd)

City of Sammamish, Tom Vance, Councilor, WA

City of Sedro-Woolley, Brenda Kinzer, Councilor, WA

City of Sedro-Woolley, Bret Sandstrom, Councilor, WA

City of Sedro-Woolley, Dean Klinger, Fire Chief, WA

City of Sedro-Woolley, Doug Wood, Police Chief, WA

City of Sedro-Woolley, Eron Berg, City Attorney, WA

City of Sedro-Woolley, Germaine Kornegay, Councilor, WA

City of Sedro-Woolley, Hugh Galbraith, Councilor, WA

City of Sedro-Woolley, Jack Moore, Planning Director, WA

City of Sedro-Woolley, Keith Wagoner, Councilor, WA

City of Sedro-Woolley, Kevin Loy, Councilor, WA

City of Sedro-Woolley, Mike Anderson, Mayor, WA

City of Sedro-Woolley, Nathan Salseina, Parks & Recreation Supervisor, WA

City of Sedro-Woolley, Rick Lemley, Councilor, WA

City of Snohomish, Corbitt Loch, Planning Director, WA

City of Snohomish, Dave Bender, Parks & Facilities Division Lead, WA

City of Snohomish, Dean Randall, Councilor, WA

City of Snohomish, Debbie Emge, Economic Development Manager, WA

City of Snohomish, Derrick Burke, Councilor, WA

City of Snohomish, Grant Weed, City Attorney, WA

City of Snohomish, John Turner, Police Chief, WA

City of Snohomish, Karen Guzak, Mayor, WA

City of Snohomish, Lynn Schilaty, Councilor, WA

City of Snohomish, Michael Rohrscheib, Councilor, WA

City of Snohomish, Paul Kaftanski, Councilor, WA

City of Snohomish, Tim Cross, Public Works Inspector, WA

City of Snohomish, Tim Heydon, Public Works Director, WA

City of Snohomish, Tom Hamilton, Councilor, WA

City of Sumas, Bob Bromley, Mayor, WA

City of Sumas, Bruce Bosch, Councilor, WA

City of Sumas, Chris Haugen, Police Chief, WA

City of Sumas, Gary Debont, Councilor, WA

City of Sumas, Jerry DeBruin, Fire Chief, WA

City of Sumas, Jim Wright, City Attorney, WA

City of Sumas, Leige Clare, Councilor, WA

City of Sumas, Mike Quinn, Councilor, WA

City of Sumas, Rod Fadden, Public Works Director, WA

City of Sumas, Todd Daniels, Councilor, WA

City of Sumner, Bill Pugh, Public Works Director, WA

City of Sumner, Brad Moericke, Police Chief, WA

City of Sumner, Brett Vinson, City Attorney, WA

City of Sumner, Cindi Hochstatter, Councilor, WA

City of Sumner, Curt Brown, Councilor, WA

City of Sumner, David Enslow, Mayor, WA

City of Sumner, Earle Stuard, Councilor, WA

City of Sumner, Greg Schwayer, WA

City of Sumner, Joe Fessler, WA

City of Sumner, Kathy Hayden, Councilor, WA

City of Sumner, Mike LeMaster, Deputy Mayor, WA

City of Sumner, Nancy Dumas, Councilor, WA

City of Sumner, Paul Rogerson, Planning Director, WA

City of Sumner, Rebecca Coleman, Permit Specialist, WA

City of Sumner, Steve Allsop, Councilor, WA

City of Tacoma Water, Real Estate Management, WA

City of Toledo, Bill Boehm, City Attorney, WA

City of Toledo, Carol Hill, Councilor, WA

City of Toledo, Craig McCown, Public Works Director, WA

City of Toledo, Guy Spratt, Councilor, WA

City of Toledo, Jerry Pratt, Mayor, WA

City of Toledo, John Brockmueller, Police Chief, WA

City of Toledo, Michelle Whitten, WA

City of Toledo, Mike Thomas, Councilor, WA

City of Toledo, Nathan Cook, Councilor, WA

City of Toledo, Steve Dobosh, Councilor, WA

City of Vader, Andy Wilson, Councilor, WA

City of Vader, Dana Williams, City Attorney, WA

City of Vader, Janet Charlton, Councilor, WA

City of Vader, Ken Smith, Mayor, WA

City of Vader, Kevin Flynn, Councilor, WA

City of Vader, Rodney Allison, Councilor, WA

City of Vader, Sean Uhlich, Police Chief, WA

City of Vader, Sharron Ross, Councilor, WA

City of Vader, Wanda Barzda, Public Works Director, WA

City of Winlock, Amanda C. Vey, City Attorney, WA

City of Winlock, Barbara Pedersen, Councilor, WA

City of Winlock, Denise Green, Councilor, WA

City of Winlock, Dennis Korpi, Councilor, WA

City of Winlock, Glen Cook, Mayor, WA

City of Winlock, Gregg Robinson, Public Works Director, WA

City of Winlock, Jerry Rader, Councilor, WA

City of Winlock, Pat Anderson, Councilor, WA

City of Winlock, Tammy Hamilton, Planning Director, WA

City of Winlock, Terry Williams, Police Chief, WA

City of Woodland, WA

City of Woodland, Al Swindell, Councilor, WA

City of Woodland, Amanda Smeller, Community Development Planner, WA

City of Woodland, Bart Stepp P.E., Public Works Director, WA

City of Woodland, Benjamin Fredricks, Councilor, WA

City of Woodland, Grover Laseke, Mayor, WA

City of Woodland, Jennifer Heffernan, Councilor, WA

City of Woodland, Marilee McCall, Councilor, WA

City of Woodland, Marshall Allen, Councilor, WA

City of Woodland, Rob Stephenson, Police Chief, WA

City of Woodland, Scott Perry, Councilor, WA

Local Government Agenies – Washington (cont'd)

City of Woodland, Susan Humbyrd, Councilor, WA

City of Yelm, Bob Isom, Councilor, WA

City of Yelm, Grant Beck, Communicty Development Dir., WA

City of Yelm, Joe Baker, Councilor, WA

City of Yelm, JW Foster, Councilor, WA

City of Yelm, Ken Garmann, Councilor, WA

City of Yelm, Mark King, Fire Chief, WA

City of Yelm, Mike McGowan, Councilor, WA

City of Yelm, Ron Harding, Mayor, WA

City of Yelm, Russ Hendrickson, Councilor, WA

City of Yelm, Ryan Johnstone, Public Works Director, WA

City of Yelm, Todd Stancil, Police Chief, WA

City of Yelm, Tracey Wood, Councilor, WA

Clark County, Anna Pendergrass, Emergency Management, WA

Clark County, David Madore, County Commissioner, WA

Clark County, Dennis Mason, County Fire Chief, WA

Clark County, Garry E. Lucas, County Sheriff, WA

Clark County, Mark McCauley, County Administrator, WA

Clark County, Oliver Orjiako, County Planning Director, WA

Clark County, Peter Capell, County Public Works Director, WA

Clark County, Sonja Wiser, Community Development, WA

Clark County, Steve Stuart, County Commissioner, WA

Clark County, Tom Mielke, County Commissioner, WA

Clark County, WA, Matt Hall, Project Manager-Dept of Public Works, WA

Clark Public Utilities, Sharon Crouch, Loss Control Manager, WA

Cowlitz Conservation District, WA

Cowlitz County Board of Commissioners, George Raiter, Chair, WA

Cowlitz County CDID #2, WA

Cowlitz County CDID #2, WA

Cowlitz County Fire District 5, Victor Leatzow, Fire Chief, WA

Cowlitz County PUD, WA

Cowlitz County Weed Control Board, WA

Cowlitz County, WA

Cowlitz County, Dennis Weber, County Commissioner, WA

Cowlitz County, E. Elaine Placido, Dir. Building & Planning, WA

Cowlitz County, Ernie Schnabler, County Emergency Management, WA

Cowlitz County, James Misner, County Commissioner, WA

Cowlitz County, Kent Cash, County Public Works Director, WA

Cowlitz County, Mark S. Nelson, County Sheriff, WA

Cowlitz County, Michael A. Karnofski, County Commissioner, WA

Cowlitz County, Phillip Rupp, Planning Manager, WA

Cowlitz County, Ron Junker, WA

Cowlitz Economic Development Council, Rotary Club of Longview, Ted Sprague, President, WA

Dept. of Public Works Environmental Permitting, Karen Streeter, Environmental Permitting Manager, WA

Dept. of Public Works-Operations Division, Dean Shadix, Sr. Engineering Technician Utility Inspection, WA

King Conservation District, WA

King County Noxious Weed Board, WA

King County Noxious Weed Control Program, Steven Burke, Manager, WA

King County, Dow Constantine, County Executive, WA

King County, Jane Hague, County Councilor, WA

King County, Joe McDermott, County Councilor, WA

King County, John Urquhart, County Sheriff, WA

King County, Kathy Lambert, County Councilor, WA

King County, Larry Gossett, County Councilor, WA

King County, Larry Phillips, County Councilor, WA

King County, Laura Casey, Environmental Scientist, WA

King County, Pete von Reichbauer, County Councilor, WA

King County, Reagan Dunn, County Councilor, WA

King County, Rod Dembowski, County Councilor, WA

King County, Ron Ainslie, Site Development Specialist, WA

King County, Walt Hubbard, Emergency Management, WA

King County-Parks, WA

Lewis County Conservation District, WA

Lewis County Weed Control, WA

Lewis County, Bill Schulte, County Commissioner, WA

Lewis County, Bob Johnson, County Planning Director, WA

Lewis County, Edna Fund, County Commissioner, WA

Lewis County, Lee Grose, County Commissioner, WA

Lewis County, Lee Napier, Community Development Dir., WA

Lewis County, Ross McDowell, Emergency Management, WA

Lewis County, Steve Mansfield, County Sheriff, WA

Noxious Weed Board, William Rogers, Coordinator, WA

Pacific County, Bryan Harrison, Pacific County Courthouse Annex, WA

Pacific County, Clay Hardwood, Commissioner, WA

Pacific County, John Kaino, Commissioner, WA

Pacific County, Mike DeSimone, Pacific County Courthouse Annex, WA

Pacific County, Norman "Bud" Cuffel, Commissioner, WA

Pierce Conservation District, WA

Pierce County Fire Protection 22, WA

Pierce County Noxious Weed Control Board, WA

Pierce County Parks, Parks & Recreation, WA

Pierce County Public Works & Utilities, Kyle Dworchak, Transportation Services, WA

Pierce County, WA

Pierce County, Transportation Services, WA

Pierce County, Brian D. Stacy, P.E., County Engineer, WA

Local Government Agenies – Washington (cont'd)

Pierce County, Brian J. Ziegler, County Public Works Director, WA

Pierce County, Brynn Brady, Government Relations Coordinator, WA

Pierce County, Connie Ladenburg, County Council, WA

Pierce County, Dan Roach, County Council, WA

Pierce County, Denise Dyer, Manager, Economic Devel, WA

Pierce County, Dennis Hanberg, County Planning Director, WA

Pierce County, Diane Ryba, Environmental Biologist, WA

Pierce County, Douglas Richardson, County Council, WA

Pierce County, Jennifer Joly, Government Relations Director, WA

Pierce County, Jennifer Walker, SR/WA, ROW Section Supervisor, WA

Pierce County, Joyce McDonald, County Council, WA

Pierce County, Kathryn Kravit-Smith, Director, Parks & Recreati, WA

Pierce County, Mark Maenhout, Director, Risk Management, WA

Pierce County, Pat McCarthy, County Executive, WA

Pierce County, Paul A. Pastor, County Sheriff, WA

Pierce County, Rick Talbert, County Council, WA

Pierce County, Roger Bush, County Council, WA

Pierce County, Stan Flemming, County Council, WA

Pierce County, Steven Bailey, Emergency Management, WA

Pierce County, Toby Rickman, P.E., Deputy Director, Public Wo, WA

Pierce County, William Sleeth, PLS, Survey Supervisor, WA

Public Utility District, Larry Saunders, WA

Skagit Co Public Utility District, Al Littlefield, WA

Skagit Conservation District, WA

Skagit County, Brian Adams, Parks & Recreation Director, WA

Skagit County, Dale Pernula, Planning Director, WA

Skagit County, Dan Berentson, Public Works Interim Director, WA

Skagit County, Gary Christensen, County Planning Director, WA

Skagit County, Kelly Blaine, County Fire Chief, WA

Skagit County, Ken Dahlstedt, County Commissioner, WA

Skagit County, Mark Watkinson, Emergency Management, WA

Skagit County, Ron Wesen, County Commissioner, WA

Skagit County, Sharon Dillon, County Commissioner, WA

Skagit County, Will Reichardt, County Sheriff, WA

Skagit Public Utility Distric, Lora Elsom, Environmental Services Coordinator, WA

Snohomish Conservation District, Monte Marti, Distric Manager, WA

Snohomish County Department of Public Works, David Evans, WA

Snohomish County Noxious Weed Control Board, WA

Snohomish County Parks & Recreation, Dianne Bailey, Park Property Administrator, WA

Snohomish County Parks & Recreation, James Yap, Principal Park Planner, WA

Snohomish County, Brian Sullivan, Councilor, WA

Snohomish County, Clay White, County Planning Director, WA

Snohomish County, Dave Somers, Councilor, WA

Snohomish County, Frank Scherf, Senior Planner, WA

Snohomish County, John Lovick, County Executive, WA

Snohomish County, John Lovick, County Sheriff, WA

Snohomish County, John Pennington, Emergency Management, WA

Snohomish County, Ken Klein, Councilor, WA

Snohomish County, Stephanie Wright, Councilor, WA

Snohomish County, Steve Thomsen, Public Works Director, WA

Snohomish County, Terry Ryan, Councilor, WA

Snohomish County, Ty Trenary, County Sheriff, WA

Thurston Conservation District, WA

Thurston County Noxious Weed Control Agency, WA

Thurston County Parks, WA

Thurston County, Cathy Wolfe, County Commissioner, WA

Thurston County, Cliff Moore, County Manager, WA

Thurston County, Cythia Wilson, Senior Planner, WA

Thurston County, Donavan Willcutt, Public Works Director, WA

Thurston County, John Snaza, County Sheriff, WA

Thurston County, Mark Swartout, Natural Resource Program Manager, WA

Thurston County, Sandra Romero, County Commissioner, WA

Thurston County, Sandra Romero, County Commissioner, WA

Thurston County, Scott Clark, Planning Director, WA

Whatcom Conservation District, WA

Whatcom County, Barbara Brenner, County Council, WA

Whatcom County, Barry Buchanan, County Council, WA

Whatcom County, Bill Elfo, County Sheriff, WA

Whatcom County, Carl Weimer, County Council, WA

Whatcom County, Frank M. Abart, County Public Works Director, WA

Whatcom County, J.E. Ryan, County Fire Chief, WA

Whatcom County, Ken Mann, County Council, WA

Whatcom County, Lyn Morgan-Hill, Senior Planner, WA

Whatcom County, Michael McFarlane, Director of Parks & Recreation, WA

Whatcom County, Pete Kremen, County Executive, WA

Whatcom County, Rodney Lamb, Design & Development Supervisor, WA

Whatcom County, Rud Browne, County Council, WA

Local Government Agenies – Washington (cont'd)

Whatcom County, Sam Crawford, County Council, WA

Whatcom County, Suzanne Bosman, Senior Planner, WA

Native American Groups

Chehalis Confederated Tribes, David Burnett, Chair, WA

Chinook Indian Tribe, Tony Johnson, Cultural Resources, WA

Chinook Nation, Ray Gardner, Council Chairman, WA

Clatsop-Nehalem Confederated Tribes, Joseph Scovell, OR

Columbia River Inter-Tribal Fish Commission, FERC Coordinator, OR

Columbia River Inter-Tribal Fish Commission, Jaime Pinkham, OR

Columbia River Inter-Tribal Fish Commission, Lumley Paul, Executive Director, OR

Columbia River Inter-Tribal Fish Commission, Patti Howard, Water Quality Coordinator, OR

Colville Confederated Tribes, Michael Finley, WA

Confederated Tribes & Bands of Yakama Nation, Kate Valdez, Cultural Resources, WA

Confederated Tribes & Bands of Yakama Nation, Philip Rigdon, DNR Deputy Director, WA

Confederated Tribes of Grand Ronde, Brandy Humphreys, OR

Confederated Tribes of Grand Ronde, Cheryle Kennedy, Chair, OR

Confederated Tribes of Grand Ronde, David Lewis, Cultural Resources Manager, OR

Confederated Tribes of Grand Ronde, Eirik Thorsgard, Cultural Resources, OR

Confederated Tribes of Grand Ronde, Erik Thorsgard, Tribal Historic Preservation Officer, OR

Confederated Tribes of Grand Ronde, Michael Karnosh, OR

Confederated Tribes of Grand Ronde, Reynold Leno, OR

Confederated Tribes of Grand Ronde, Schultz Khani, Cultural Resources Specialist, OR

Confederated Tribes of Siletz, Robert Kennta, OR

Confederated Tribes of the Chehalis, Mark White, Natural Resources, WA

Confederated Tribes of the Chehalis, Richard Bellon, Cultural Resources, WA

Confederated Tribes of the Umatilla, Board of Trustees - Chair, OR

Confederated Tribes of the Umatilla, Bruce Zimmerman, OR

Confederated Tribes of the Umatilla, Carey Miller, THPO, Cultural Resources Protection Program, OR

Confederated Tribes of the Umatilla, Catherine Dickson, Cultural Resources, OR

Confederated Tribes of the Umatilla, Les Minthorn, Chair, OR

Confederated Tribes of the Warm Springs Reserv, Sally Bird, Cultural Resources Manager, OR

Confederated Tribes of the Warm Springs Reservation of Oregon, Eugene Greene Jr., Chairman, OR

Cowlitz Indian Tribe, Bill Iyall, Chair, WA

Cowlitz Indian Tribe, Dave Burlingame, Cultural Resources, WA

Cowlitz Indian Tribe, Ed Arthur, Assistant Director, WA

Cowlitz Indian Tribe, Mike Iyall, Natural Resources Director, WA

Cowlitz Indian Tribe, Taylor Aalvik, Natural Resource Director, WA

Hoh Tribe, Maria Lopez, WA

Jamestown S'Klallam Tribe, Ron Allen, WA

Kalispel Tribe, Glen Nenema, WA

Kikiallus Indian Tribe, Kurt Weinreich, Cultural Resources, WA

Lower Elwha Klallam Tribe, Frances Charles, WA

Lummi Nation, Lena Tso, Cultural Resources, WA

Lummi Nation, Merle Jefferson, Natural Resources, WA

Lummi Nation, Timothy Ballew II, WA

Lumni Nation, Cliff Cultee, Chair, WA

Makah Tribe, Timothy Greene, Sr., WA

Muckleshoot Indian Tribe, Cultural/Preservation, WA

Muckleshoot Indian Tribe, Fisheries, WA

Muckleshoot Indian Tribe, Planning, WA

Muckleshoot Tribe, Karen Walter, Natural Resources, WA

Muckleshoot Tribe, Laura Murphy, Cultural Resources, WA

Muckleshoot Tribe, Virginia Cross, Chair, WA

Nez Perce Tribal Executive Committee, Brooklyn Baptiste, Chairman, ID

Nez Perce Tribe, Ryan Sudbury, Office of Legal Council, ID

Nisqually Tribe, Cynthia Iyall, Chair, WA

Nisqually Tribe, David Troutt, Natural Resources, WA

Nisqually Tribe, Dorian Sanchez, Chair, WA

Nisqually Tribe, Fabio Apolito, Cultural Resources, WA

Nisqually Tribe, Joe Kalama, Cultural Resources, WA

Nisqually Tribe, Thor Hoyte, WA

Nooksack Tribe, Gary MacWilliams, Natural Resources, WA

Nooksack Tribe, George Swanaset Jr., Cultural Resources, WA

Nooksack Tribe, Jeffrey Thomas, Natural Resources, WA

Nooksack Tribe, Kelly, Jr Robert, Chair, WA

Port Gamble S'Klallam Tribe, Jeromy Sullivan, WA

Puyallup Tribe, Bill Sullivan, Natural Resources, WA

Puyallup Tribe, Brandon Reynon, Cultural Resources, WA

Puyallup Tribe, Dillon, Sr. Herman, Chair, WA

Quileute Nation, Tony Foster, WA

Quinault Nation, Fawn Sharp, WA

Samish Nation, Christine Woodward, Natural Resources, WA

Samish Nation, Jacquelyn Ferry, Cultural Resources, WA

Samish Nation, Thomas Wooten, Chair, WA

Sauk-Suiattle Tribe, Michael Hoffman, Chair, WA

Sauk-Suiattle Tribe, Norma Joseph, WA

Sauk-Suiattle Tribe, Norma Joseph, Cultural Resources, WA

Sauk-Suiattle Tribe, Richard Wolten, Natural Resources, WA

Shoalwater Bay Tribe, Charlene Nelson, Chair, WA

Native American Groups (cont'd)

Shoalwater Bay Tribe, Earl Davis, Cultural Resources, WA

Shoalwater Bay Tribe, Gary Burns, Natural Resources, WA

Shoalwater Bay Tribe, Tony Johnson, Cultural Resources, WA

Siletz Confederated Tribes, Delores Pigsley, Chair, OR

Skagit River System Cooperative, Stan Walsh, Environmental Services Manager, WA

Skokomish Tribe, Charles "Guy" Miller, WA

Spokane Tribe, Rudy Peone, WA

Squaxin Island Tribe, Dave Lopeman, WA

Steilacoom Indian Tribe, Danny Marshall, Chair, WA

Stillaguamish Tribe, Jay Harvey, Cultural Resources, WA

Stillaguamish Tribe, Pat Stevenson, Natural Resources, WA

Stillaguamish Tribe, Shawn Yanity, Chair, WA

Suquamish Tribe, Dennis Lewarch, Cultural Resources, WA

Swinomish Indian Tribal Community, Larry Campbell, Tribal Historic Preservation Officer, WA

Swinomish Tribe, Brian Cladoosby, WA

Tulalip Tribe, Melvin Sheldon, Jr., WA

Tulalip Tribe, Richard Young, Cultural Resources, WA

Upper Skagit Tribe, Jennifer Washington, WA

Upper Skagit Tribe, Scott Shuyler, Cultural Resources, WA

Yakama Nation, Harry Smiskin, Chair, WA

Yakama Nation, Jerry Meninick, Chair, WA

Intervenors

Allen Neuringer, OR

Astoria Fire & Rescue, Michael Jackson, Asst. Chief/Fire Marshal, OR

Astoria Police Dept., Robert Deu Pree, Chief of Police, OR

Atmos Energy Corporation, Kevin Frank, TX

CC Meisel Co Inc., OR

Center for Biological Diversity, Sarah Uhlemann, Senior Attorney, WA

City of Astoria, Brett Estes, City Manager, OR

City of Molalla, Mike Clark, City Manager, OR

City of St. Helens, John Walsh, City Administrator, OR

City of Warrenton, Kurt Fritsch, City Manager, OR

Clatsop County, Scott Derickson, County Manager, OR

Columbia County, Sarah Hanson, Columbia County, OR

Columbia River Inter-Tribal Fish Commission, Rob Lothrop, Policy Development/Litigation Support Manager, OR

Columbia Riverkeeper, Daniel R. Serres, OR

Confederated Tribes of Grand Ronde, Senior Staff Attorney, OR

D. Richard & Louise E. Fischer, OR

Daniel J & Matiele Law, WA

Davidson Family LLC, Jerry Mullen, OR

Flood & Water Watch, Julia DeGraw, OR

Joint Water Commission, OR

Jordan Ramis PC, Ronald Guerra, City Attorney for St. Helens, OR

Laurie Caplan, OR

Lolita and Menton A. Carl LLC, OR

Lori Durheim, OR

Morris and Victoria Baxter, AZ

National Marine Fisheries Service, Dr. Jeff Fisher, Branch Chief-Southwest Region, WA

National Marine Fisheries Service, Jane Hannuksela, WA

National Marine Fisheries Service, Mischa Connine, OR

Northwest Environmental Defense Center, Marla S. Nelson, OR

Northwest Industrial Gas Users, Edward A. Finklea, Exuecutive Director, OR

Northwest Natural Gas Co, OR

Old Standard Life Ins Co., WA

OR Dept. of Energy, Shanda Shribbs, OR

OR Dept. of Environmental Quality, Nina DeConcini, Northwest Region Administrator, OR

OR Dept. of Fish & Wildlife, OR

OR Dept. of Land Conservation and Development, Patty Snow, OR

OR Dept. of State Lands, Steve Purchase, OR

OR Parks & Recreation Dept., OR

OR Water Resources Dept., OR

Oregon Coast Alliance, Cameron La Follete, Land Use Director, OR

Oregon Shores Conservation Coalition, Courtney Johnson, OR

Pinnacle Long, LLC, Kell, Alternman, & Runstein, LLP, Attorneys (Pinnacle), OR

Post & Schell, P.C., Douglas Canter, DC

Saddleback Neighborhood Road Maintenance Association, Lee Geil, President, WA

Southwest Gas Corporation, Keith Layton, Associate General Counsel, NV

Southwest Gas Corporation, Pamela Ruckel, Senior Analyst Federal Regulatory Affairs, NV

Southwest Gas Corporation, Sam Brown, Manager/Federal Regulatory Affairs, NV

Teresa Charboneau, WA

WA Dept. of Ecology Shorelands & Environmental Assistance, Loree Randall, WA

WA Dept. of Fish and Wildlife, David Brock, Program Manager, WA

WA Dept. of Natural Resources, Rochelle Knust, External Affairs Program Lead, WA

WA Dept. of Natural Resources, Terence Pruit, Assistant Attorney General, WA

Waterkeeper Alliance, Lesley Adams, Western Regional Coordinator, OR

Willamette Riverkeeper, OR

Libraries

Astoria Public Library, OR

Auburn Library, WA

Black Diamond Library, WA

Centralia Timberland Library, WA

Covington Library, WA

Forest Grove City Library, OR

Ilwaco Timberland Library, WA

Issaquah Public Library, WA

Kalama Library, WA

Kelso Public Library, WA

McMinnville Public Library, OR

Monroe Library, WA

Sammamish Library, WA

Sedro-Woolley Public Library, WA

Snohomish Library, WA

South Hill Library, WA

Sumner Library, WA

Warrenton Community Library, OR

Winlock Public Library, WA

Woodburn Public Library, OR

Woodland Public Library, WA

Media

Bellingham Herald, Managing Editor, WA

Chinook Observer, WA

Chronicle, Managing Editor, WA

Forest Grove Times-News, Christian Gaston, OR

Issaquah Press, Kathleen Merrill, Managing Editor, WA

KMUN Radio, Joanne Rideout, OR

Longview Daily News, Managing Editor, WA

Longview Daily News, Eric Olson, Reporter, WA

News-Register, Steve Bagwell, OR

Nisqually Valley News, Kevin Graves, Editor and Publisher, WA

Puyallup Herald, Andrew Fickes, Reporter, WA

Puyallup Herald, Tyler Hemstreet, Managing Editor, WA

Skagit Valley Herald, Managing Editor, WA

Skagit Valley Herald, Gina Cole, Reporter, WA

The Chronicle, Kyle Spurr, WA

The Daily Astorian, OR

The Hillsboro Argus, Nick Christensen, OR

The Oregonian, OR

The Oregonian, Lori Tobias, OR

Vernonia's Voice Newspaper, Scott Laird, OR

Willamette Week, Nick Budnick, OR

Woodburn Independent, John Gervais, OR

Entities and Organizations

1000 Friends of OR, OR

2014-1 IH Borrower LP, TX

410 Associates LLC, Ronald Goodchild, WA

64th Street Apartments, LLC, WA

94Th Avenue LLC, WA

AFBM II LLC, OR

Alco, WA

Allito Properties LLC, WA

American Concrete Inc, Bob Beeson, WA

American Eagle Mtg Mexico #200 LLC, WA

American Equities Inc., Ross Miles, WA

American Gas Association, President, DC

American Savings Bank, NC

APA Development LLC, Kurt Brunner, WA

Appleton Development LLC, WA

Arch Wood Protection Inc, GA

Ariniello Properties, LLC, WA

Ashton D Group LLC, WA

Association of Washington Business, Kris Johnson, President, WA

Astoria Ford, Dane Gouge, OR

Astoria-Warrenton Area Chamber of Commerce, OR

Auburn Lions Club, WA

Auburn School Dist 408, Randy Thomas, Dir. Of O & M, WA

BAC Home Loans Servicing LP, CA

Bahr Tree Farm LLC, Steve Pedersen, WA

Bank of New York Mellon, UT

Bauder Family Limited Partnership, OR

BBC LLC, Brie Garland, WA

BCC Puyallup LLC, WA

Benham Property LLC, WA

Berean Baptist Church, WA

Blue Breeze, LLC, WA

BNSF Railway Company, TX

Bordeaux / Cameray HOA, WA

BR Valley Townhomes Sub Dst II Flanagan-Orion, Jennifer Spears, IL

Brandley Investments Inc, Jim Brandley, WA

BRC Family LLC, WA

Brewer's Sports Complex, LLC, Jeff Backmeier, WA

Brick House Wine Company, M. Mills, OR

Brookshire Estates HOA - Issaquah, WA

Brookshire Ridge HOA, WA

Buchan Homes LLC, WA

Building and Planning Dept., Carolyn Johnson, WA

Buy2Fix, LLC, Scott Emry, WA

Cameray HOA, WA

Canyon Road Property LLC, WA

Caporn Skies, LLC, WA

Car Wash Enterprises Inc., WA

Carpenter's Local 156, Kevin Weller, OR

Entities and Organizations (cont'd)

Casa Associates, Claire Petersen, KAMG Mgmnt, WA
Cascade Natural Gas Corp, ND
Cascade Natural Gas Corp, WA
Cascade Water Alliance, WA
Cascade West Development Inc, WA
Castle Rock Fuel Stop Inc, Manjit Singh Chahil, WA
Cava Materials LLC, WA
CCJ Inc, OR
Cedar Springs at I LLC, WA
Celebration Center, WA
Cemetery Dist #1, WA
CH2MHill, Jay Lorenz, OR
CH2MHill, Mark Bricker, WA
Chilton, Inc., WA
Chrystal Farm, LLC, Lindley Morton, Manager, OR
Church of Jesus Christ LDS, UT
Clackamas County Farm Bureau, Jon Iverson, OR
Cleaning Services, Richard Lee, WA
Clover Creek Highlands LLC, Schilt M Seabrook, WA
Coastal Condo LLC, OR
Cohiba, Cripple Crk, French Crk Hunt Club LLC, Scott Gunning, WA
Coleman Ranch, OR
Columbia Bank, Jim Duncan, WA
Columbia Colstor Inc., WA
Columbia River Bar Pilot, Robert Johnson, OR
Columbia River Bar Pilots, Gary Lewin, OR
Columbia River Business Alliance, Don West, OR
Columbia River Estuary Study Taskforce, Jay Flint, OR
Columbia River Estuary Study Taskforce, Robert Warren, OR
Columbia River Maritime Museum, Jerry Ostermiller, OR
Columbia River Maritime Museum, Sam Johnson, Executive Director, OR
Columbia River Pilots Association, David Halmagyi, OR
Columbia Riverkeeper, Cheryl Johnson, OR
Columbia Riverkeeper, Debi Donnelly, OR
Columbia Riverkeeper, Ted Messing, OR
Consolidated Products Int Inc, OR
Cowlitz Community Foundation, William Iyall, Chairman, Cowlitz Indian Tribe, WA
Cowlitz Dairy, WA
Creator Lutheran Church At Lake Tapps, WA
Crest Builders, WA
Crystal Creek Holdings LLC, WA
Darzolf Holdings LLC, WA
Davidson Family LLC, OR
DD&V Company LLC, Dennis Derr, WA
DE & ME Enterprises LLC, WA
Deer Island Stock Ranch Trust, OR
Deutsche Bank Trust Co, TX
Dewitt Investments LLC, WA
Dieringer School Dist 343, WA
Doneen Inc, Anne Hanschu, OR
Dorel Properties LLC, Eric Pries, WA
Down To Earth Enterprises LLC, Starr Tavenner, WA
DRK, LLC, WA
Drllevich Const Inc, WA
Dubuque Crest HOA III, WA
Duenhoelter LLC, WA
Dyno Nobel Inc, UT
E & E Gradline LLC, Mark Ekman, WA
E/B Work LLC, WA
East Echo Lake LLC, WA
East West Real Estate Inv, WA
Eastridge Christian Assembly, Pete Blum, WA
Echo Lake Community Church, WA
Echo Lake Estates HOA, Brian Kovacevish, WA
Eight Is Enough LLC, WA
Endeavor Properties, LLC, WA
Englund LLC, OR
Estates Homeowners Assn, Morris Management, WA
exp Energy Services Inc., Mike Aubele, TX
Federal National Mortgage A, CA
Field Services, Inc., Leslie Benckendorf, OR
Fir Lane Valley LLC, WA
Fire District 44, Mike Barlow, WA
Fire Mtn Farms, Robert J Thode, WA
First Svgs Bk NW, WA
Forest Canyon Park LLC, WA
Forestree GM LLC, WA
Four Crowes, WA
Four Seasons Farms, Inc, Bernie James Stratton, WA
Fox Hill HOA, Eric Seislove, WA
Fraternity Snoqualmie Inc, WA
FREO Washington, LLC, AZ
Friends of Living OR Waters, Daniel Serres, OR
Fruithill, Inc, Lee Schrepel, OR
Fulbright & Jaworski, LLP, Lisa Tonery, NY
General Steel Corp., CA
Glenbrooke Apartments, WA
Goodyear Nelson Lumber Co, Rod Remington, WA
Gradawn LLC, Paul N Best, WA
Grand Ridge Country Estates, Frederick Detore, II, WA
Grandma Jane's LLC, WA
Green Diamond Resource Co, David Backstrom, WA
Grigg Properties LLC, WA
Gusman & Magnuson Trust, WA
Gwin & Sons Logging Co., OR

Entities and Organizations (cont'd)

Hampton Lumber Mills Inc., OR

HDR, Patricia Terhaar, MN

Helgaland LLC, Tom Burke, WA

Herbrand Company, Dan Miller, WA

Hidden Glen MHC LLC, CA

Highland Ridge LLC, Kent Landerholm, WA

Highlands At South Hill LLC, WA

High-Level, LLC, WA

Hill Family LLC, Shelly Smith, WA

Holt Distressed Property Fund 2010, Scott Miller, WA

HRRUS LLC, OR

HSH Beauty, WA

Hubbard Seed & Supply Co., Gordon Jones, OR

IH4 Property Washington LP, AZ

Illahee Homeowners Assoc, WA

Ilwaco Fisherman, John Grocott, WA

Invitation Homes Property Management, WA

Issaquah Highlands Comm, Sarah Phillips, Executive Director, WA

Issaquah Montessori Property, WA

Issaquah Rotary Club, WA

Issaquah School Dist, Nancy Wilson, WA

Jacoby-Bigelow Trust, WA

Jansma Construction Inc., WA

Jeff Akins Inc, WA

Jenny Creek Properties, LLC, Craig Pfeifer, WA

John Hancock Mutual Life Ins. Co., WA

Jordan Ramis PC, E. Andrew Jordan, OR

Jorgensen Timber LLC, WA

JRS Lost Lake LLC, WA

KCT Investments, Robert E. Kimball, WA

Kinder Cemetery, OR

Klahanie HOA Association, WA

Knife River Corporation - Northwest, OR

Knutson Farms Inc, Roger, WA

L&D Race Tech, Don Hall, OR

Lake Tapps Community Church, WA

Lamon LLC, WA

LDS Church Real Estate, Scott Williams, UT

Lemay Investments LLC, WA

Level 3 Communications, Bruce A Kolancy, CO

Lincoln Trust Company FBO, WA

LJF Properties, WA

Llama Landing HOA, WA

Longview Pioneer Lions, Doug Harvey, WA

Lopez Farm LLC, WA

Lower Columbia Alliance for Sustainable Fishing, Bernie Bjork, OR

Lower Columbia River Estuary Partnership, Deborah Marriott, OR

LPORT 2 (WA) QRS 16-147 Inc., WA

Mallard Marsh LLC/Smartweed LLC, Richard Bus, WA

Manorwood North Division III Association, WA

Marine Mammal Commission, Michael Gosliner, MD

Max J Kuney Co, WA

Meridian Greens HOA, WA

Meridian Greens LLC, WA

Meridian Place LLC, OR

Meridian Square LLC, JSH Properties, WA

Milestone Homes Inc., WA

Molalla Community Planning Organization, Jim Gilbert (Chair), OR

Molalla Community Planning Organization, Susan Hansen, OR

Morris & Morris & McNeil, Marcia McNall, LA

Moskee Investment Company, OR

Mount Vernon Lions Club, WA

MP Properties LLC, WA

N Pacific Dist Of The Bible, WA

Nehls 2011 Trust, CA

Nelson Condominiums, WA

Nevil Financial Lmtd. Partnership Etal, WA

North Coast Watershed Association, OR

Northwest Commercial Investments LLC, WA

Northwest D/D Inc., WA

Northwest Environmenal Defense Council, Corey Moffet, OR

Northwest Environmental Defense Center, OR

Northwest Gas Association, Dan Kirschner, Executive Director, OR

Northwest Industrial Gas Users, Paula Pyron, OR

Northwest OR Regional Partnership, Shirley Kalkhoven, OR

NW Real Properties LLC, WA

OLNG, Peter Hansen, WA

Olympia Timber Holdings, LLC, WA

Olympic Acupuncture, WA

Olympic Pipeline Co, James Prince, CA

Olympic Pipeline Co., IL

Oneill Storage LLC, WA

OR Fishermen's Cable Committee, Jeff Kroft, OR

OR Shores Conservation Coalition, Frank Fromherz, OR

OR Wild, Doug Heiken, OR

Orusic2 LLC, OR

Overlook Crest LLC, Rob Janicki, WA

P & C Land Co LLC, OR

Pacific Coast Seafoods Co, OR

Pacific Lifestyle Homes, Inc., WA

Pacific Natural Gas Co, C T Corporation System, WA

Pacific Park LLC, WA

Entities and Organizations (cont'd)

Pacifica Poplar Inc, John Fitzpatrick, BC

Palmer Creek Water District Improvement Company, Robert May, OR

Penny Lane Company LLC, WA

Pente Winlock LLC, Harry Hanna, OR

Pierce College Puyallup, WA

Pipe Line Contractors Assoc., TX

Port of Astoria, OR

Port of Astoria, Herb Florer, Deputy Director/Interim Executive Director, OR

Port of Ilwaco, Cindy Wigard, WA

Port of Kalama, Mark Wilson, Development Director, WA

Port of Tacoma, WA

Port of Woodland, Nelson Holmberg, Executive Director, WA

Port Warren Moorage Assoc., OR

Port Warren Sea Lion LLC, OR

Puget Sound Energy & Elec, WA

Puget Sound Energy & Gas, WA

R D Farms Inc., Steve Davidson, OR

Racca Rentals LLC, WA

Radars Marsh LLC, WA

RB40 LLC, Coy Anglin, WA

Redmond Lions Club, WA

Reeve Resources LLC, NV

Renaissance Ridge HOA, Don Corbett, WA

RESOLVE, Paul DeMorgan, OR

Ridge At Woodbrook HOA, VIS Group INS, WA

Ridgecrest Development III LLC, Ross Miles, OR

Ridgeview Estates Assoc, S. Roscoe, WA

River Grove Apartments LLC, WA

Riverwalk Condominium Association, WA

RJE Real Estate LLC, WA

Robin Hill LLC, WA

Rocky Mountain P/L Constr Assoc., J.D. Lormand, LA

Rotary Club of Sammamish, WA

Rotary Club of Snohomish, WA

Salmon for All, Inc, Oliver Waldman, OR

Samuel & Antoinette Lapore Trust, WA

Sandy Glen HOA, Lindsey Nagle, WA

Sarbanand Farms LLC, CA

Saxony-Pacific LLC, OR

Schmoe Forest Land LLC, WA

SE 111th St Water & Rd Association, David Shallow, WA

Sea Spray Prop., OR

Seaside Signal, John Yoakum, OR

Seppa Dairy Co, OR

Seurity State Bank, WA

Shaw Road Development LLC, Kurt Brunner, WA

Sierra Club - OR Chapter, Ted Gleichman, OR

Sister Keeper Homes LLC, WA

Skookumchuck Dam LLC, Tom Emrich, AB

Smartweed LLC, Robert E Manger, WA

Snohomish Lions Club, WA

Sound Development Corp., WA

South Hill Christian Center, Dennis Cummins, WA

South Valley Estates, WA

Stag Hallow Wines, LLC, Jill Zarnowitz, OR

Star Feets, LLC, WA

Steadfast LLC, OR

Steve Burnstead Construction L, Leo, WA

Summa Real Estate Group, Diane Jette, Principal Broker, OR

Summit Bank, WA

Sunset Empire Transportation District, OR

Suzuki & Used Cars, Vincent Williams, OR

Tacoma Pierce Co YMCA, WA

Tafa Properties LLC, WA

Tanca Ioan, WA

Tapps 3205 LLC, WA

Teevin Brothers Land & Timber co., Shawn Teevin, OR

Teitzel Selchert LLC, WA

The Boeing Company, M/C 20-00, WA

The Brookshire East HOA, WA

The Crest on the Plateau, HOA, WA

The Longview Rotary Club, Allan Erickson, President, WA

The Wilderness Society, Resource Economist, CO

THR Washington II LP, AZ

Three Ps Development LLC, OR

Timberland Bank, WA

Timberland Homes Assoc., Inc., WA

Toutle River View HOA, WA

Trailwood Farms, WA

Transalta Centralia Mining LLC, Tim LeDuc, WA

Tree Farm Association of lot Owners, WA

Trestine LLC, Lorie Spogen, WA

Tualatin River Watershed Council, April Olbrich, OR

Twin Gables LLC, WA

Union Pacific Railroad Co., Renay Robison, NE

US Partner Co Ltd, WA

Verizon Northwest, Inc, TX

Village At Rivergrove HOA, Robin Shea, WA

WA Assn Mgt Svcs LLC, WA

WA Development Co Inc, MT

Warrenton Lumber Mill, Dale C. Williams, Unit Manager, OR

Washington Water Power Co - El, Nick Floros, WA

Wasser & Winters, WA

Water Rights Services Division, Jerry K. Sauter, Water Rights Program Analyst, OR

Entities and Organizations (cont'd)

Waterlands LLC, WA

Wellman Woodland LLC, OR

Wells Fargo Bank Minnesota Na, UT

Wells Fargo Bank NA, SC

Wesley Homes, Kevin Anderson, WA

Westside Community Bank, Peter Lofgren, WA

Wetland & Waterways Conservation, Michael McCabe, Senior Resource Coordinator, OR

Weyerhaeuser Columbia Timberlands LLC, WA

Weyerhaeuser Columbia Timberlands LLC, Chris Lipton, WA

Weyerhaeuser Columbia Timberlands, LLC, Wesley Schlenker, WA

Weyerhaeuser Company, Dale Williams, Unit Manager Warrenton Lumber Mill, OR

Weyerhaeuser Company, Tax Dept. CH1C28, WA

Weyerhaeuser NR Company/Lewis & Clark Oregon Buyer LLC, OR

WGW Inc, John Ottis, WA

Whatcom Land Trust, Eric Carobba, WA

Wildernest, WA

Willams Northwest Pipeline GP, Pam Barnes, UT

Williams Communications, Pete Johnson, CO

Williams Pipeline, Albert Michini, UT

Williams Pipeline, George Angerbauer, UT

Williams Puyallup Office, Rex Johnson, Land Supervisor, WA

Williams, Dallas Scholes, Sr. State Gov't. Affairs Rep., UT

Williams, Emily Kushlan, UT

Williams, Matt Kautzman, WA

Windsor Park Estates Puyallup LLC, WA

Winkelman Farm LLC, WA

Woodland America LLC, WA

Yamhill County Farm Bureau, Zach Christensen, OR

Yamhill District Improvement Company No. 1, Ron Schindler, OR

Yinkay Heritage Inc, Philip L Thom, WA

Yoder Sparling LLC, WA

Zimlar Tree Farms, Leah Larson-Saroni, CA

Zimlar Tree Farms, Lynden Larson-Magnoli, CT

Individuals

Aaron & Rachel Lamb, WA

Aaron C & Victoria A Watt, WA

Aaron Colvin, WA

Aaron D & Melody A Molen, WA

Aaron J & Kimberly A Blindheim, WA

Aaron N & Leah M Dunsdon, WA

Aaron Puckett, WA

Abbie Sullivan & Christopher Taylor, WA

Abbilene Overton, WA

Abigail Ziltener, WA

Abraham M S & Shin Quon Goo, WA

Adam & Autumn Link, WA

Adam & Kiekenapp, Katie Schukantz, WA

Adam & Lori Hoffman, WA

Adam Hillard, WA

Adam J & Erin J Bluett, WA

Adam Levine, WA

Adolph H & Linda L Krantz, WA

Adrian P & Kirsten A B Happel, WA

Adrian Santangelo, WA

Ahna Lich, OR

Ahren & Shannon Minsch, WA

Aileen Taylor, WA

Alan D & Ethyl L Schumacher, WA

Alan H Homestead, WA

Alan K. & Joyce Asher Nicholson, WA

Alan Lee Buswell, WA

Alan Makayev, WA

Alana Dittrich, WA

Albert E & Patricia A Szymusiak, WA

Aleksandr & Ludmila Bugaychuk, WA

Aleksey A & Yelena V Petrov, WA

Alex & Cassandra Buchanan, WA

Alex & Daryna Bozhko, WA

Alex & Lotti Finke, OR

Alexander Baldwin & Inkyung J. Lee, WA

Alice Dewell, WA

Alice F Furgeson, CA

Alice Smith, OR

Allan & Diane Mount, WA

Allan R Guenther, WA

Allan W & Karen Oudean, WA

Allen & Kim Ward, WA

Allen A Turner, WA

Allen E Berg, WA

Allen K & Terry L Loftis, WA

Allen L & Mary A Chick, WA

Allen Muramoto, WA

Allen S & Bobby J McElhaney, WA

Allison Ciancibelli, WA

Alvin & Agnes Jensen, WA

Amber Allison, WA

Amber Clayton, WA

Amelia D. Acosta, WA

Amityikram & Dora Rajkhowa, WA

Ammon Jay & Nicole M Harris, WA

Amos R Ipock, WA

Amy D Larson, WA

Amy K Hausrath, WA

Individuals (cont'd)

Amy Smith, WA
Amy Wicklund, WA
Andrea & Ryan M. Sangrey, WA
Andres Rosas, WA
Andrew & Ann Mackenzie, WA
Andrew & Diana Druschba, WA
Andrew C & Frida R P Richwine, WA
Andrew Cier, OR
Andrew Douvier, WA
Andrew Drummond, OR
Andrew E & Chona Z Kubiak, WA
Andrew E & Janice Harlin, WA
Andrew E Haynie, WA
Andrew J & Linda D Poplawski, WA
Andrew K & Lacey J Heinz, WA
Andrew L & Deborah L O'Brien, WA
Andrew M Soethe, WA
Andrew Nygaard, OR
Andrew Rosenberger, OR
Andrew Ulven, OR
Angela & Mustafa Ameen, VA
Angela M Broome, WA
Angus Carmichael, WA
Anita Tavernier, WA
Ann K Slonecker, WA
Ann M. Hutchinson, WA
Ann Marie Willson, WA
Ann Pappas, WA
Ann Ukockis, OR
Anna Folejewski, WA
Anna L Simsich, WA
Anna M. Fleming & John Sweet, WA
Anna Parsons, WA
Anna Rogers, WA
Anne E & Gabriel W Spencer, WA
Anne Horner, OR
Anne Marie Shultz, WA
Annie Oliver, OR
Ann-Marie Becker, WA
Anthony & Adina Zerwig, WA
Anthony & Hui-Pun, Ching Pun, WA
Anthony & Pamela Diana, WA
Anthony & Park, Christie Chrestler, WA
Anthony Harbison, WA
Anthony Lee Rask, OR
Anthony M & Diane C Mayta, AZ
Anthony Ray, WA
Antonio E., Jr & Miriam Ramirez, WA
Antoune Family Trust, WA
April S Collett, WA
Arbutus Grendahl, WA
Arjun Mitra, WA
Arlene M & Patrick F Gallagher, WA
Arnold & Barbara Odegaard, WA
Arnold D Horath, WA
Arnold Gomez, WA
Arnold Haberstroh, WA
Arnold Olson, WA
Aron Lee & Barbara M Larsen, WA
Art & Wilma Yenter, WA
Art Pearl, OR
Artem & Yelena Palich, WA
Arthur B Sandford, WA
Arthur Bein, MN
Arthur E & Nancy J Francis, WA
Arthur H Schwerzel, WA
Arthur L Bobb, WA
Arthur W Erickson, OR
Ashely Burns & John M. Eisenbacher, WA
Ashley & Nina Henderson, WA
Ashley G Skeen, WA
Ashok Bavanla, TX
Ashok K Singh, WA
Aunnit White & David A. King, WA
Aurelia Sanders, Wa
Austin Guss, WA
Auston H Mathis, WA
B Bernard, OR
B Warren & Melissa G Myers, WA
Barbara Cervantes-Gautsch, OR
Barbara J Justice, WA
Barbara J Mckay, WA
Barbara J Roberts, WA
Barbara Jackson, WA
Barbara Kalinoski, WA
Barbara L Wollman, WA
Barbara Morton, WA
Barbara Perelra, OR
Barbara Roller, WA
Barbara Wright, WA
Barbara, H Herbold, OR
Barney & Rhonda Melnrick, WA
Barrie M & Starr L MacDonald, WA
Barry & Susanna Foster, WA
Barry Hinkson, OR
Barry Ulman, WA
Beatrice Jankins, WA

Individuals (cont'd)

Beatrice Kister, WA
Becky Beasley, WA
Becky Moody, WA
Behzad & Lindsay D Pakzad, WA
Ben R & Tammy S Wilcox, WA
Ben W Twight, WA
Benjamin & Kathryn Stuart, WA
Benjamin & Monica Meyette, WA
Benjamin J. & An Culver, WA
Benjamin L Norwood, WA
Benjamin T Humphreys, WA
Benjamin Warren & Lys Mercier, WA
Berkley R Keith, WA
Bernadette Butterworth, WA
Bernard E. & Michael H. Dykshoorn, BC
Bernard R Brunson, WA
Bernard Vogt, WA
Bernice Meyer, WA
Bernie West, WA
Bertha Koplitz, WA
Beth Call, WA
Betha Gutsche, WA
Bethany Lynn, WA
Bette Pierson, WA
Bettina Bradley, WA
Beverley Collins, OR
Beverly Ann Crocker, WA
Beverly Berkholtz, OR
Beverly Huu, WA
Beverly Smith, WA
Bill Booth, OR
Bill Dickas, OR
Bill Hanson, OR
Bill Sauber, OR
Bill T Wold, WA
Bill W & Janet M Barnes, WA
Billie & James Garber, WA
Billie J. Swalla, WA
Billie Schmidt, WA
Billy D. & Brenda J. Click, WA
Billy G Johnson, OR
Billy Gene Johnson, OR
Binda Douglas, WA
Blair S & Beth C Tuck, WA
Bo & Kellie Manary, WA
Bob D & Michele Eaves, WA
Bob Finnigan, OR
Bob Goldberg, OR
Bobby C Krigbaum, WA
Bobby J & Kristine K Nichols, WA
Bogdan & Brygida Bednarek, WA
Bohnda O'Donnell, WA
Bonnie Mager, WA
Brad Deaver, WA
Brad J & Wright, Deletha Little, WA
Brad M & Carol L Weber, WA
Brad McBride, WA
Brad S & Carolyn I Barber, WA
Bradford & Bridget Cochrane, WA
Bradford Kropp, WA
Bradley Buchanan, WA
Bradley Cowan, OR
Bradley D Baker, WA
Bradley Heil, OR
Bradly R & Parsons Temple Zlotoff, WA
Brady C & Linda L Jacobs, WA
Brady L & Christie I Stevens, WA
Brady Preheim, OR
Brandee L Warren, WA
Brandon & Leah Richner, WA
Brandon & Shaffer, Sunny Smith, WA
Brandon A Clayton, WA
Brean Hobbs & Corey Smith, WA
Brenda Gazabat, WA
Brenda MacRoberts, OR
Brenda Recor, WA
Brendan S & Heather Brosnan, WA
Brent B & Cindy B Gow, WA
Brent K & Kari B Hoke, WA
Brett & Bethany Wise, WA
Brian & Cara Wright, WA
Brian & Erin Lorence, WA
Brian & Joanie Ganske, WA
Brian & Mary Jane Purvis, WA
Brian & Shannon Griffith, WA
Brian A & Cindy E Welk, WA
Brian C & Susan Barrett, WA
Brian Craig Freeland, OR
Brian D & Andrea L Garvey, WA
Brian G & Rebecca L Leonard, WA
Brian K Carter, WA
Brian K. & Deborah M. Miedema, WA
Brian L Kenkman, WA
Brian L. & Susannah L. Conrad, WA
Brian M McGuiness, WA
Brian Osche, WA
Brian R McClain, WA

Individuals (cont'd)

Brian S & Suzanne J Lange, WA
Brian S. & Kristin M. Isakson, WA
Brian Wilson, WA
Brock M Lenhart, WA
Bruce & Joni McKenzie, WA
Bruce & Shawnan M Becker, WA
Bruce & Valerie Thompson, WA
Bruce A Kincy, WA
Bruce C & Melissa J Groenewegen, WA
Bruce E & Kristen Nichols, WA
Bruce G Blackstone, WA
Bruce Stock, OR
Bryan & Linda Stowe, WA
Bryan & Rebecca Biggs, WA
Bryan Gilbert, OR
Bryan M & Monica L Besteman, WA
Bryan R Plog, WA
Bryan Rowlands, WA
Bryan W. Sample & Jennifer L. Gorton, WA
Bryce Eckhart, WA
Bryn E & Marie J Volkman, NC
Bryon K & Connie A Fauchald, WA
Buford E & Judith O Welsh, WA
Burl & Kang Yang Sullivan, WA
Byung Jin Yang, WA
C Murray Twelves, WA
Calvin J & Elissa D Bruno, WA
Calvin Patterson, WA
Calvin R & Marilyn M Dickerson, WA
Cameron & Amy L Birk, Wa
Cameron Brister, OR
Candace M France, WA
Candis L Taylor, WA
Cara Story, WA
Cardyn Vena, OR
Careen Stoll, WA
Carey Mcquesten, OR
Carl & Lynnette Law, WA
Carl A. & Betty Lou Romtvedt & Curtis & Rosemary Goche, WA
Carl Burns, WA
Carl Dominey, OR
Carl Harold Carlson, CA
Carl Kisaberth, OR
Carl L & Juanita M Carlson, WA
Carl L Roth, WA
Carl Ronzheimer, OR
Carla C & Michael D Reynolds, WA
Carla Kelley, WA
Carlos A & Oku, Ayumi Melendez, WA
Carlos Martinez, OR
Carmen E Preciado, WA
Carmen J & Olvera Sara Olvera, WA
Carmen Rawlings, WA
Carol Crawford, WA
Carol Davis, OR
Carol Graham, WA
Carol Hewitt, WA
Carol J. Borgaard, WA
Carol L Markewitz, OR
Carol Mcnair, OR
Carol Newman, OR
Carol Pellett, WA
Carol Terry, OR
Carole Bernhardt, WA
Carole Hildebrandt, OR
Carole J.C. Campbell, WA
Caroline Kimler, OR
Carolyn Eady, OR
Carolyn H Clapp, OR
Carolyn Lindau-Gill, WA
Carolyn M Verner, OR
Carolyn M. Geertsma & Robert A. Geertsma, WA
Catherine Matthias, OR
Catherine McKenzie, WA
Catherine Siskron, OR
Catherine Walters & Charles K. Jones, WA
Cathy Hendrickson, WA
Cathy Lindsay, WA
Cathy Tombow, WA
Cem H & Laura J Ullman-Onener, WA
Chad Rankin, WA
Chaeil & Kyong Bok Pak, WA
Chan, WA
Chanthou & Sounn Tepsovanmony Lach, WA
Charlene A Doran, WA
Charles & Colleen Beauregard, WA
Charles & Darcy Ross, WA
Charles & Gretchen Grant, WA
Charles A & Aura L Schreiner, WA
Charles A & Chriseth L Hass, WA
Charles A Petschke, WA
Charles B Kimmel, OR
Charles B., Jr & Donna L Pearman, WA
Charles C & Janet K Duncan, WA
Charles D & Julianne McEwen, WA
Charles D Carman, WA

Individuals (cont'd)

Charles Dralle, WA
Charles E & Erin M Eaton, WA
Charles E & Martha C Schaffer, WA
Charles F., Jr Osborn, WA
Charles Garner, WA
Charles Hughes, WA
Charles J Clark, WA
Charles J., Jr & Linda G Sandor, WA
Charles L Dean, WA
Charles L Royse, WA
Charles M Patton, OR
Charles N Wilson, WA
Charles R & Kelley Smith, WA
Charles R. Jones, WA
Charles S Washer, WA
Charles Schweigert, OR
Charles Straughan, OR
Charles V Helming, WA
Charlotte Buck, WA
Charlotte Winslett, OR
Chen Suh Chyn & Larry L. Broad, WA
Cheng-Taou & Lin, Chia-Ling Chou, WA
Cheol-Min & Lee, Hyn Young Park, WA
Cheree' Turner, WA
Cheri Howe, WA
Cheryl J. McDowell, OR
Cheryl S Hannon, WA
Chester E Wells, WA
Chester R & Tana L Britton, WA
Chloe Davenport, WA
Chol Soon Shin, WA
Chris & Autumn Bock, WA
Chris & Jensen, Georgi Shoemaker, WA
Chris & Julie Mardis, WA
Chris & Katie Edwards, WA
Chris Bridgens, OR
Chris C. Ness, WA
Christi Packard, WA
Christian Bernard & Cary Wade, WA
Christian M Johnson, WA
Christina & David L. Heim, WA
Christina Alexander, OR
Christine A. Straight, OR
Christine Henkel, WA
Christine L Mahaffey, WA
Christine Landry, WA
Christine M & Melvin R Greiser, WA
Christine M & Melvin R. Greiser, WA
Christine North, OR
Christine Su, WA
Christine Underwood, WA
Christine Whitehall, WA
Christofer Joe Beacock, WA
Christopher & Ann E Wenrick, WA
Christopher & Lisa Kirby, WA
Christopher & Melinda Brown, VA
Christopher & Susan Bruder, WA
Christopher A Johnson, WA
Christopher and David Koh, CO Trustees, WA
Christopher D Dideon, WA
Christopher D Prochazka, WA
Christopher Farrar, OR
Christopher J & Wendy H Hagle, WA
Christopher L Rask, OR
Christopher Lamb, OR
Christopher P & Rebecca H Pierce, WA
Christopher P Tuohy, WA
Christopher S & Bobbie J Roth, WA
Christy Ann Peschl, OR
Cindy Carder, OR
Cindy Daly, OR
Cindy L Littlejohn, WA
Cindy Price, OR
CJ Abbott, OR
Claire A & Joshua W Douglas, WA
Claire Keeble, WA
Clarence L. Westhoff, WA
Clarica Parsons, WA
Clark C., Sr. & Barbara S. Gould, WA
Clark C., Sr. Gould, WA
Claudia DeLoff, OR
Clay A & Claire R Keith, WA
Clay S & Patricia L Benner, WA
Clinton & Rachelle Nowels, WA
Clinton A & Stefanie J Kilborn, WA
Clinton Abbott, WA
Clivonne Corbett, OR
Clyde A & Sally Shetler, WA
Clyde J & Patricia A Hall, WA
Cody & Heather A Leckner, WA
Colin Donnelly, WA
Colin Donoghue, OR
Colin Elder, WA
Colin Riley, WA
Colleen Burnett, WA
Colleen Porter, WA
Connie Paulsen, OR

Individuals (cont'd)

Connie R Beyers, WA
Connie Y & Oppenheimer Nakano, WA
Connor N. Smith, WA
Cordell N Stone, WA
Cornelius-Eileen K Vreugdenhil, WA
Craig A & Catherine C Hawkins, WA
Craig A Seader, WA
Cruz Elpidio, OR
Curtis & Carolyn Lacy, WA
Curtis Clifford, WA
Curtis L & Joyce Robinson, WA
Curtis L & Laura D Counley, WA
Curtis R & Debra L Baxstrom, WA
Curtis Vanselus, WA
Cynthia Kaul, WA
Cynthia Robinson, WA
D Adair Drynan, OR
D. Anderson, WA
D. E. & T. R. Otterstrom, WA
D. Mcclelland, OR
D. Salochana & Lalesh Chand, WA
Da Ouk, WA
Daisy E Cissna, WA
Dale & Darline Pruett, WA
Dale A Clarke, OR
Dale Albert & Shari K Roth, WA
Dale Allen Guidi, OR
Dale Barrett, OR
Dale Boon, WA
Dale D Klein, WA
Dale E & Myra A Clark, WA
Dale E Holtzworth, WA
Dale E. & Amy K. Boultinghouse, WA
Dale F Slanger, WA
Dale L & Cheril A Erickson, WA
Dallas J., Jr Dyer, WA
Dan & Alicia L Wislocker, WA
Dan & Ranum, Jennifer Murray, WA
Dan Berentson, WA
Dan Coyne, WA
Dan Cronenwett, WA
Dan K & Cathy J Loholt, WA
Dan L & Eunice Defreece, WA
Dan Lyon, MT
Dan Miller, WA
Dan Serres, OR
Dan W & Gracie Jansen, WA
Dan William Heiner, OR
Dan Williams, WA
Dana L Mattson, WA
Dana M. Klatt, WA
Dana W Holton, WA
Dana Zia, OR
Danay S & Teresa R McIntryre, WA
Dane & Anne Egenes, WA
Danial Kennedy, WA
Danieil Green, OR
Daniel & Amy Duefrane, WA
Daniel & Arliss Benz, WA
Daniel & Christin Raymond, WA
Daniel & Davis, Kristin Ferguson, WA
Daniel & Elizabeth Detloff, WA
Daniel & Elizabeth Hanlon, WA
Daniel & Ellen Cain, WA
Daniel & Jo Eva Parker, WA
Daniel & Ligia Iorga, WA
Daniel & Mary Ann Hogue, WA
Daniel A & Silvia L Peterson, WA
Daniel Anthony Giluck, WA
Daniel Armstrong, OR
Daniel B Breen, WA
Daniel B Rosenthal, WA
Daniel Bergeron, OR
Daniel D & Jenni Sillito, WA
Daniel Dinh, WA
Daniel E & Alisa D Lahaie, WA
Daniel E & Bonnie R Ritola, WA
Daniel F & Lori J Cockerham, WA
Daniel G Sanders, WA
Daniel Green, OR
Daniel J & Ashley A Kristofzski, WA
Daniel J & Cynthia R Winston, WA
Daniel J & Karen M Hauser, WA
Daniel J & Melissa A Rogers, WA
Daniel J & Valerie Bryant, WA
Daniel J. & Nathan B. Spencer, WA
Daniel L & Sherrie L Baily, WA
Daniel L & Sylvia M Hertlein, WA
Daniel L Diiullo, WA
Daniel M & Rebecca L McManus, WA
Daniel Maguire, WA
Daniel Ogren, OR
Daniel P & Katrina M Scott, WA
Daniel Q & Carolina C Rouse, WA
Daniel R & Barbara M Presseisen, WA
Daniel R. Serres, OR
Daniel Rouslin, OR

Individuals (cont'd)

Daniel V Vasquez, WA
Daniel Weishaar, WA
Danny L & Shirley R Price, WA
Dante Jesus & Liezl Arranza, WA
Darcey B & Regina Teets, WA
Darcie Babcock, OR
Darcie C & Rafael Lessante, WA
Darcy Walker, WA
Daren S & Lesley Rogers, WA
Darlene Turner, WA
Darlene V Bellman, WA
Darrel Claymore, WA
Darren & Danielle Sterling, WA
Darren Godbey, WA
Darron L Whitehead, WA
Daryl E & Tracy A Tanner, WA
Daryl W. & De Etta Connite, WA
David & Audrey Antkowiak, WA
David & Catherin Anderson, WA
David & Chong S Cutarelli, WA
David & Cindy Rudisill, WA
David & Cydney Lewis Nixon, WA
David & Darlene Thompson, WA
David & Linda Dorough, WA
David & Lynn Thornton, WA
David & Megan Edwards, WA
David & Perish, Anthony McDowell, WA
David & Sandra Egge, WA
David & Terrie Espinoza, WA
David & Terry Taylor, WA
David & Victoria Levinson, WA
David & Wendy Knoeppel, WA
David (Trustee) McKeel, OR
David A & Susan M Smith, WA
David A Belden, OR
David A Pierot, WA
David A. Thompson Sr., OR
David Ambrose, OR
David B & Tricia A Bagley, WA
David Black, WA
David C & Mutita P Honsberger, WA
David Carter, WA
David Cruickshank, OR
David D & Ajia A Davies, WA
David D & Joan D Dawson, WA
David D Borden, WA
David Danielson, OR
David Drury, OR
David E & Hanna Dalia Sabath, WA
David E. & Carey L. Allison, WA
David Eugene Power, WA
David G & Kathy A Elkins, WA
David G & Kay J Chevalier, WA
David G & Shirley R Krause, OR
David Gill, WA
David Glass, OR
David Goldman, OR
David H & Irma E Gross, WA
David Hall Stewart, WA
David J & Heather A Vitzthum, WA
David J Fraser, WA
David J. & Michelle R. & Christine L. Prestin, WA
David Jones, OR
David Jones, OR
David K & Toni L Smith, WA
David L & Jean M Rule, WA
David L & Kathryn J Morgan, WA
David L Webb, OR
David L Wells, WA
David L. & Leslie Hughes, WA
David M McLaughlin, WA
David McMahon, WA
David N & Jennifer Allen, WA
David N & Sherry L Heiserman, WA
David P & Phuong T Hebert, WA
David Paul & Amy Elizabeth Tallbut, WA
David Plate, OR
David R & Cheryl S Wheeler, WA
David R & Jean H Seeley, WA
David R & Tammy L McCabe, WA
David R & Tresa Nelson, WA
David R Eatwell, WA
David R Swords, WA
David S & Deborah S Masters, WA
David S. & C. Carpenter; & Darryl & D. Brown, WA
David Schmitz, WA
David T & Valerie L Patterson, WA
David T Walworth, WA
David T. & Barbara E. Moore, WA
David W & Harris-Riley, Sarah L Riley, WA
David W & Judith A Foskette, WA
David W & Kendra Richard, WA
David W Raines, WA
David Yager, OR
David Zanghi, WA
Dawn Clark, OR
Dawn Zuger, WA

Individuals (cont'd)

Dean & Betty Gross, WA
Dean & Jodie Anderson, WA
Dean A Kaufman, WA
Dean Allen Owens, OR
Dean D Lee, WA
Dean Flaig, WA
Dean Johnson, WA
Dean N Sorensen, WA
Dean Phelps, OR
Dean Su, WA
Deane R & Rachel E Wood, WA
Deann Ketchum, WA
Deanna Devereaux, WA
Deanna L Hungerland, WA
Debbra K. Edwards & James C. Pointere, WA
Deborah Cain, WA
Deborah M Marvil, WA
Deborah McBeath, WA
Debra A Bachmeier, WA
Debra Hines, OR
Debra L. Joh & Charlie, Jr West, WA
Delbert & Colleen Ferree, WA
Delene M Brayer, WA
Dell Goldsmith, OR
Della Johnson, WA
Della M. Walker, WA
Delores S Lumberg, WA
Deloris F Jones, WA
Delta Ockert, OR
Dena Frances Baker-Davis, WA
Dena Paffenroth, WA
Denis Douglas Meunier, OR
Denise Cornwell, WA
Dennis & Adam Biwit, WA
Dennis & Amy Gronholdt, WA
Dennis & Shirley & Michael Roberts, WA
Dennis Callegari, OR
Dennis D & Judy A Walter, WA
Dennis D & Maureen L Fehrenbach, WA
Dennis E Holzer, WA
Dennis F Koher, WA
Dennis G Smith, WA
Dennis Hanes, OR
Dennis Heller, WA
Dennis Higgins, OR
Dennis J Mazelin, WA
Dennis L & Karen J Karnes, WA
Dennis M., Sr Dodge, WA
Dennis P. & Kathle Bibko, WA
Dennis R & Evelyn J Erceg, WA
Dennis W. Sennert, WA
Dennis Warren, OR
Denyse Lockard, WA
Derek & Bozlee, Breann Spence, WA
Derek & Kristin Rand, WA
Derick & Ames, Linda Allen, WA
Devender Daniel & Debra Van, WA
DeWayne & Dannella Jensen, WA
Diana Boom, OR
Diana Keller, OR
Diana L & Bryce R Reynolds, WA
Diana L & Mark A Haley, WA
Diana M Loback, WA
Diana McCarty, WA
Diana S Bright, OR
Diane Amarotico, OR
Diane Dick, WA
Diane E Gould, WA
Diane Greenberg, WA
Diane Heath, OR
Diane Stearns, OR
Diane Zink, OR
Dianna P Spence, OR
Dianne Frothingham, WA
Dianne McChesney-Davis & Thomas Davis, WA
Dick & Leona McArthur, WA
Diedre M Clarke, WA
Diljit & Dang Sethi & Kanwaldeep, WA
Dion Kiene-Wheeler, WA
Dirk E & Kristen Volcke, WA
Dmitriy & Iryna Aleksandruk, WA
Dodie Needham, WA
Doe M. & Scott H. Hartz, WA
Dolores L. Sannicolas & Chris D. Comstock, WA
Dolores Zella E Nugent Nugent, WA
Domonick Sanchez, OR
Don & Charlotte Larison, WA
Don Carson, OR
Don E Sims, WA
Don Hennig, OR
Don Mills, OR
Dona D Palmer, WA
Donald & Betty Ansel, WA
Donald A. & Nancy J. Sundvick, WA
Donald E & Kathleen K Mundy, WA
Donald E & Kathy J Fourre, WA
Donald E & Marian L Ely, WA

Individuals (cont'd)

Donald F Beatty, WA
Donald Falleur, OR
Donald G & Jacqueline J West, WA
Donald G Winter, WA
Donald H & Emma J Hemminger Rev Living Trust, Donald H. & Emma J. Hemminger, WA
Donald J & G Nadeane Jensen, WA
Donald J & Minnie E Trentman, WA
Donald Johnson, OR
Donald L Berg, WA
Donald L Pugh, WA
Donald M Sykes, WA
Donald Mangini, WA
Donald McDaniel, WA
Donald Morden, OR
Donald R & Jane M Carbaugh, WA
Donald R & Kathryn A Rushton, WA
Donald R & Kathy R Dibblee, WA
Donald R Kennedy, WA
Donald R Staley, WA
Donald R Swanson, WA
Donald R Wallace, WA
Donald S. Lieurance, WA
Donald T Sanders, WA
Donald V. Bergerson, OR
Donna & Ricardo Casanova, WA
Donna Baker, WA
Donna Loomans, WA
Donna Osborne, OR
Donnie Lee & Sheryl Ann Herring, WA
Donnie R. & Rudine V. Mayfield, WA
Doris Corrado, OR
Dorothy A Harju, NV
Dorothy Carpenter, WA
Dorothy I Park, WA
Dorothy L & Daniel I Buell, WA
Dorothy Leu, WA
Dorothy R. Mooney, OR
Doug Huigen, WA
Doug Lofting, OR
Doug N & Nicole M Kiger, WA
Douglas & Shaune Godfrey, WA
Douglas A Meyer, WA
Douglas D Burns, WA
Douglas Faron, WA
Douglas J Almond, WA
Douglas J Perry, WA
Douglas J Weber, WA
Douglas Morrison, WA
Douglas P & Joy E Miller, WA
Douglas R Crim, WA
Douglas S Roth, WA
Douglas Speers, OR
Douglas Werner, WA
Douwe & Leona Van Ess, WA
Doyle & Arlene Johnson, WA
Drew & Ashlee Evans, WA
Drew Herzig, OR
Duaine A. Hiler Etux, WA
Duane & Connie Bryant, WA
Duane & Jeanette Tevelde, WA
Duane Clausen, OR
Duane Clausen, OR
Duane E & Diane C Hahn, WA
Duane T. & Vivian T. Cordray, WA
Duc Do, WA
Dustin Y & Alison Greer, WA
Dysa Kafoury, WA
Eahou R & Nicole D Davis, WA
Earl & Carmen Henderson, WA
Earl C Lauth, WA
Earl Lee Hyatt, WA
Earl Powers, OR
Earl Wright, OR
Earlene Rothauge, WA
Ed Frodel, WA
Ed J & Kelly A Depaoli, WA
Eddie Fusaro, WA
Eddie J Leach, WA
Edith A & Judi A Lovelace, WA
Edith S. Orner, OR
Edmund W., Jr Roller, WA
Edward & Jacqueline Peterson, WA
Edward & Pamela Klopfer, WA
Edward & Penny Zenker, WA
Edward & Terry Holtgraves, WA
Edward A & Carol B Dayoob, WA
Edward A & Christina G Martinez, WA
Edward A & Helen K Solem, WA
Edward A & Susan Klatkiewicz, WA
Edward A Fletcher, WA
Edward A Tilzer, WA
Edward Archie Dass, OR
Edward B Angus, OR
Edward D. & Tamera Malakoff Barrows, WA
Edward Durham, OR
Edward E & Molly E Evans, WA

Individuals (cont'd)

Edward G & Christine G Coleman, WA
Edward J & Helen G Schlotfeldt, WA
Edward L & Bethel K Johnson, WA
Edward M & Krista M Olson, WA
Edward Panowicz, OR
Edward R & Jennifer C Herda, WA
Edward Stratton, OR
Edward, L Bayly, Or
Edwin & Linda Massey, WA
Edwin C. & Kathleen D. Sharpe, WA
Edwin J & Myrna L Hume, WA
Edwin Q & Jennifer W Tam, WA
Efrain & Laurie Sanchez, WA
Eileen and Victor Chieco, OR
Eileen R Boman, WA
Eino Johnson, OR
Ekta Mittal, WA
Eldon D & Rebecca S Baumgardner, WA
Elfriede H Kristwald, WA
Eli & Kaela Holm, WA
Elinore Darland, OR
Elisabeth Bondy, WA
Elisha S & Judy E Harris, WA
Elizabeth A Roberts, WA
Elizabeth C Haba, WA
Elizabeth H Coker, OR
Elizabeth Keyser, OR
Elizabeth R Larson, WA
Elizabeth R. Carnay, WA
Elizabeth Rankine, WA
Elizabeth S Noorwood, WA
Elizabeth Vreugdenhil, WA
Elizabeth W Rogers, WA
Ellen Bondurant, OR
Ellen Carpentier, WA
Ellen Odmark, WA
Ellen R. O'Hern, WA
Ellen Saunders, OR
Elma E Monts, WA
Elmer M & Marjory Hoover, WA
Elpidio Cruz, OR
Elton & Fritzi M Edwards, WA
Emil L & Kristin M Williams Liedtke, WA
Emily J. Montreuil & Richard T. McCartney, WA
Emory J Gerhart, WA
Erc Mendenhale, WA
Eric & Barbara Lopez, WA
Eric & Lisa Brunner, WA
Eric B & Cheryl A Smith, WA
Eric B McLeroy, WA
Eric Burr, WA
Eric C & Courtney J Grimstad, WA
Eric C. Stroud, OR
Eric Chase, WA
Eric D & Daniel Webster Wilkerson, WA
Eric D & Kristina K Swanson, WA
Eric Devereaux, WA
Eric Grechko, WA
Eric J & Andrea G Haley, WA
Eric Johnson, WA
Eric K & Melinda D Ness, WA
Eric L T Johnson, WA
Eric M & Tracy A Haines, WA
Eric W & Julia A Sims, WA
Erich Freitas, WA
Erick P. Bennett, OR
Erik Halvorson, WA
Erin G & Robert W Stevens, WA
Ernest O'Byrne, OR
Ernest W & Elsie M Moffet, WA
Ernie Laulainen, WA
Ernie Loreen, WA
Escott L Gardiner, WA
Estelle Voeller, OR
Eugene & Ida Vangrinsven, WA
Eugene M Bleth, WA
Evelyn J Wilson, WA
Evelyn M & Owens, Leah Tte Miller, WA
Everett G & Eileen M Meyer, WA
Ezra D. Baldwin, WA
Farhad & Lida Mottaghian-Milani, WA
Farrell Orton Farms LLC, WA
Fay Payton, WA
Felicia Cohen, OR
Ferdinand Mark P & Girlie A Flores, WA
Finn R Christiansen, WA
Flick D Broughton, WA
Florin Baias, WA
Floyd L., Sr Voie, WA
Floyd Prozanski, OR
Francis C & Adanne J Jeffries, WA
Francis E. Quinn, OR
Francis G & Pamela K Humiston, WA
Francis J & Larene K Durning, WA
Francisco Santiago, WA
Frank & Joan Wagner, WA
Frank Falco, OR

Individuals (cont'd)

Franklin & Margarita Molina, WA
Franklyn Henry, WA
Frans Eykel, WA
Franz Puhl, OR
Fred & Darlene Furukawa, WA
Fred White, OR
Fred, Jr Hamm, WA
Frederick A & Carol A Mathers, WA
Frederick Graves, WA
Frederick K Go, CA
Frederick M & Dorothy F Lowell, WA
Frederick R Revocable Trust ET AL Bernet, OR
Fredrick L & Cristi Casebolt, WA
Fritz E. & Louise M. Abhold, WA
G. Dianne & Gilmore I., Jr Peterson, WA
Gabe C Fields, OR
Gabriel V Cruceanu, WA
Gabriele Bartholomew, WA
Gail J Poole, WA
Gail Lovelady, WA
Gail M. Zmok, OR
Gail Sorensen, WA
Gale A & Penny S Massey, WA
Gale M. Fitterer & Gregory Jon Wagner, WA
Galen Davis, WA
Gansler Trust, WA
Gary & Pamela Hendrickson, WA
Gary & Sandra Chittenden, WA
Gary & Sherylynn Dettwiller, WA
Gary & Susan Rogers, Wa
Gary & Wiggins, Whitney Lagerstrom, WA
Gary A Alexander, WA
Gary Barnett, OR
Gary Cannell, WA
Gary Cotton, WA
Gary Dyer, WA
Gary E & Debroah R Nicklett, WA
Gary F & Debbie R Daniels, WA
Gary K Johnson, WA
Gary L & Chrysler Dana L Chrysler, WA
Gary L & Debra D Hatfield, WA
Gary L & Edith A Thomas, WA
Gary L & Jacquelyn K Knaus, WA
Gary L Sylte, WA
Gary M. & Rebecca & David Ferderer Cline, WA
Gary Massoni, OR
Gary N Robertson, WA
Gary Norman, WA
Gary R. Howard, WA
Gary T & Becky Ribelin, WA
Gary W & Brigid K Totten, WA
Gary W & Kari L Carlin, WA
Gary Witteman, OR
Gary Ziak, OR
Gayle & Jerome Kroke, WA
Gayle Kiser, WA
Gayle RogersBullington, WA
Gene & Kim, Eun Jung Oh, WA
Gene & Magdalena Ross, AZ
GENIE L LIVING TRUST & DAVID L FOLSOM, WA
Geoffrey A & Lorna D Mueller, WA
George & Dona Loflin, WA
George & Judy Keith, WA
George & Julia Hemminger, WA
George & Maricel Abenojar, WA
George A Biggerstaff, WA
George and Caroline Trice, WA
George E & Heather H Holcomb, WA
George E & Portia Wilcock, WA
George Exum, WA
George Georgitsis & Scott Overby, WA
George Hague, OR
George L & Bernice E Brunelle, WA
George N. Ying Lin Lawrence, WA
George Paradis, WA
George R & Sandra L Roscoe, WA
George S & Patricia A Krencik, WA
George W. & Sharon R. Kinkade, WA
George Warren, OR
George William Wiemerslage, WA
Georgina Boyson, WA
Gerald & Jody R Bentler, WA
Gerald & Vicki Mylan, WA
Gerald A & Janet L Welch, WA
Gerald Copeland, OR
Gerald G Clark, WA
Gerald Holubiczko, AZ
Gerald L & Cherie M Kiger, WA
Gerald L & Judith L Lange, WA
Gerald Lindquist, WA
Gerald Peterson, WA
Gerald R & Marie A Johnson, WA
Gerald R Lemmons, OR
Gerald T & Shirley L TTEE Hodgins, WA
Gerald W Walstad, WA
Geri Roubidoux, WA
Gerold D & Lori A Parsons, WA

Individuals (cont'd)

Gerry & Myldred Cunnington, WA
Gerry R & S K Anderson Curtis, WA
Ghose Sayata & Marcus Belcher, WA
Gilbert & Leta R Goethals, WA
Gilbert D Snyder, WA
Gilbert Rodriguez, WA
Gina L Andrews, WA
Gladys T Ramsdell, WA
Glen Harter, WA
Glenn E Bagley, WA
Glenn Gilbert, WA
Gloria Miniszewski, OR
Gordon E Howe, WA
Gordon J & Kathy M Francis, WA
Gordon W & Nadeene Wiebe, WA
Govindaswamy Bacthavachalu, WA
Grace Moore, WA
Gray Mckee, OR
Greg & Christiane Carder, WA
Greg Blomstrom, CA
Greg Hanon, WA
Greg Mecklem, OR
Gregg K & Cynthia K Cunningham, WA
Gregory & Amanda Nelson, WA
Gregory & Smith, Evon Andal, WA
Gregory & Vanhout, Gretch Johnson, WA
Gregory B & Charlotte R Proulx, WA
Gregory Cecil, WA
Gregory E & Angela M Hovde, WA
Gregory N & Brandi L Marvin, WA
Gregory S & Danielle L Watson, WA
Gregory S & Patricia E McVey, WA
Gretchen E Vanbrunt, WA
Guadalupe Reifers, WA
Guerdon C Ellis, WA
Gust A & Tricia M Jahner, WA
Gwen L. McMahon, OR
H. Bernard, IV & Kristen L. Hansen, WA
Hank & Ruth Leenstra, WA
Hank Mrazkowski, OR
Hans G & Ann K Lindstrom, WA
Hans J & Hazel A Siebert, WA
Harley Pfaff, WA
Harnek & Sohi Ananteeep Kaur Dhudwal, WA
Harold A Matz, WA
Harold D & Elizabeth A Disharoon, WA
Harold E & Gertrude L Britton, WA
Harold Gaskin, OR
Harold Grass, OR
Harold J & Kathleen I Rupe, WA
Harold Palmer, WA
Harriet Berman, OR
Harriett Mckim-Smith, OR
Harris E & Elaine M Cox, WA
Harry B. & Doris A. Anderson, WA
Harry G Cumming, OR
Harry K D O'Neill, WA
Harry L & Darlene R Woolery, WA
Harry L Bond, WA
Harry O Clements, WA
Hassan & Shahla Ghassemieh, WA
Hazel Caldwell, WA
HDR, Matt Hutchinson, OR
He & Fan, Yi Tiangi, WA
Heather & Moerch, Tony D Shaw, WA
Heather Greene-Beloit, WA
Heather Marx & Corey Ray, WA
Hector A P & Siragusa Mariscol C Matos, WA
Hector L & Zina M Rodriguez, WA
Heidi Buchwald, WA
Heidi Matheney, OR
Heidi Newsome, WA
Helen & Perry E. Johnson Living Trust, Helen Johnson, NJ
Helen Jean Tillotson, WA
Helen Moore, OR
Helen, Trust Dtd 11-23-09, Et Al Johnson, NJ
Helena M Wester, OR
Helon Howard, OR
Henry & Carol Hayes, WA
Henry & Kathleen Vandermeulen, WA
Henry E Whittlesey, WA
Henry Meeker, OR
Henry N. & Tanis Miller, WA
Henry O'Brien, OR
Herbert A Wilke, WA
Herbert H & Grace Killam, WA
Herbert Lloyd G & Rudge, Barbara Knowles, WA
Herbert M. & Nancy Jean Wiseman, WA
Herman Barnett, WA
Herman Gotfrid Conrad Nix, WA
Higgins Living Trust & Robert W. Higgins, WA
Hikojiro & Sharon E Katsuhisa, WA
Hoi Man Sun, WA
Hollis Paul, WA
Holly A. Grenz & Allen J. Grenz, WA
Holly Ann Rogers, WA
Holly L & Jonathan H James, WA

Individuals (cont'd)

Holly Rickles, WA
Hong Wan, WA
Hongzeng & Liu Fengfen Guo, WA
Howard B & Lisa C Nelson, WA
Howard Clark, WA
Howard E III & Janet G Bowers, WA
Howard L., Jr & Jana Herrold, WA
Hugh A & Janet L Grimoldby, WA
Hugh A Hillis, WA
Huiqin Jiang, OR
Hye Kyung Kim, WA
Ian Jezorek, WA
Ian Quinones, WA
Ik Jung & Eun Hee Seo Chun, OR
Ila E Hawkes, OR
Innes McLaren, OR
Ioan & Raveca Muntean, WA
Irene & Arnold Coon, WA
Irene & Howard G. Judd, WA
Irene Bensinger, WA
Irene Embrey, WA
Irene M. Suver, WA
Ivan E & Terry Jensen, WA
Ivan O. Anderson, WA
Iwona Marciniak-Glabek & Arkady Glabek, WA
J Richard & Tami Baalman, WA
Jack & Jackie Bruner, WA
Jack & Janice Bothwell, WA
Jack A. Goodson, WA
Jack Dalton, OR
Jack E Hughes, WA
Jack K & Danelle L Sanders, WA
Jack L Wray, WA
Jack M & Kathryn C Frost, WA
Jack M Turk, WA
Jack Oates, WA
Jack P & Suzanne C Edwards, WA
Jack R & Kathy I Green, WA
Jack Radey, OR
Jackie Melvin, OR
Jackie Orton, WA
Jackie Sorensen, OR
Jacob A Rummel, OR
Jacob W & Jennifer L Miller, WA
Jacqueline Lorenzen, WA
Jagdish & Sibylle Singh, WA
Jai Hari S Khalsa, OR
Jaime & Priscilla Cerna, WA
Jaime & Spengler, John & Link, WA
Jamee J Tate, WA
James & Carol Fare, WA
James & Carole Gay, WA
James & Carole Lowman, WA
James & Connie Jo Dykstra, WA
James & Doris Lott, WA
James & Gumhan Kim, WA
James & Krishanthi Nelson, WA
James & Marsha Wilson, WA
James & Melinda Riley, WA
James & Vernalee Lindemann, WA
James A & Cristi A Acuna, WA
James A & Norma Douvier, WA
James A West, WA
James A. & Laura J. S. Laudolff, WA
James A. Douglas, WA
James B & Cynthia L Badham, WA
James B & Rebecca A Potter, WA
James B & Shea A Craver, WA
James B & Sheryl M Schmidt, WA
James C & Crystalina D Hyatt, WA
James C Ralph, WA
James E & Camela M Sutton, WA
James E & Carrie J Olesen, WA
James E & Cynthia L Elder, WA
James E & Jillene K Holter, WA
James E & Lisa Thomas, WA
James E. Lee, OR
James E. Spiess, WA
James E., Jr & Evelyn Brooks, WA
James F Koch, WA
James F. O'Hearn & Todd L. Kody, WA
James G. Moore, WA
James H & Leanne R Miller, WA
James H & Shirley W Echols, WA
James Holman, OR
James K Lee, WA
James Kalberer, WA
James Kellett, WA
James L & Lucille S Langland, WA
James L & Vonnie E Milden, WA
James L McFall, WA
James L. Martini, OR
James Lee Lancaster, WA
James Leonard, WA
James Leroy Dillinger, WA
James Lyle & Alic Hardenburgh, WA
James M & Jane C Bond, WA

Individuals (cont'd)

James M & Marcie R Fricke, WA
James M & Vicki L Wagner, WA
James M., Jr Johnson, WA
James McClasky, WA
James Neikes, OR
James Nichols, OR
James O & Shirley J Boldt, WA
James O & Tammy L Ludlow, WA
James O Kimball, WA
James P & Kelly M Bramell, WA
James P & Marylan L Kelly, WA
James P Dailey, WA
James P Kennedy, WA
James R Gallaugher, WA
James R. & Shannon R. Silvernail, WA
James R., Jr & Janet L. Carson, WA
James Reith, OR
James S., Jr & Heide A. Hudson, WA
James Schuler; & E. W. & Therese Gordon, WA
James T Kreofsky, WA
James Taylor, WA
James W & Eugenia K Fenton, WA
James W Richard, WA
James W Tootell, WA
James Wallace, WA
James Y Kim, WA
Jamie & Joshua A Taylor, WA
Jamie & Peter Quinlan, WA
Jamie Lee Stewart & Jacqueline Miller, WA
Jan Petree, OR
Jan Rinehart, OR
Jan Walker, WA
Jane & Shimoda, Terryll Ronngren, WA
Janet Allen, WA
Janet and Daniel A. Dommasch, OR
Janet Ross, WA
Janet Vaillancourt, OR
Jani J Kelly, WA
Janice Baker, WA
Janice E Jonas, WA
Janice Eller, OR
Janice L George, WA
Janice Levi, OR
Janis A Leikam, WA
Jared C & Janelle N Mike, WA
Jared L Hamrick, WA
Jason & Elaine Noack, WA
Jason & Kristalyn March, WA
Jason & Megan Turner, WA
Jason & Stephanie Lucier, WA
Jason & Toni Brown, WA
Jason & Wentz, Stepheney Eley, WA
Jason Brim, OR
Jason D & Gabriel A Omat, WA
Jason Ford, WA
Jason G & Krystal L Strand, WA
Jason Howell, WA
Jason L & Sommer S Lindell, WA
Jason R & Donna M Holland, WA
Jason Sweeney, OR
Jay & Megan M Marchand, WA
Jay & Vallone Ben Vallone, WA
Jay B & Pamela J Penick, WA
Jay K & Nicole C Gusler, WA
Jay M Weil, OR
Jay R. & Bernadette M. Lind, WA
Jay W Garthwaite, WA
Jayn Foy, WA
Jean C Boyd-Wylie, WA
Jean M & Susan C Kattar, WA
Jeanette L Mishler, WA
Jeanne A Lohmann, WA
Jeanne Brooks, OR
Jeanne Hochstein, WA
Jed M & Michelle L Woodward, WA
Jeff & Lynda Schwindt, WA
Jeff & Michele Friesel, WA
Jeff C. Variel, OR
Jeff R & Gail L Hemstead, WA
Jeffery A & Candy D McVey, WA
Jeffery K & Tahlia M Butler, WA
Jeffery K. & Karen R. Jansma, WA
Jeffrey & Marta Smith, WA
Jeffrey & Mildred De Marre, WA
Jeffrey & Rebbecca Krone, WA
Jeffrey & Reichlin, Danise Robinson, WA
Jeffrey & Shannon Von Forell, WA
Jeffrey & Tina Ko, WA
Jeffrey A & Cheri S Jacobsen, WA
Jeffrey A Davis, WA
Jeffrey Campbell, WA
Jeffrey Ellwood, WA
Jeffrey H Chivers, FL
Jeffrey J Conwell, WA
Jeffrey L & Cynthia E Akins, WA
Jeffrey M & Lora Patterson, WA
Jeffrey M & Naoni E Elliott, WA

Individuals (cont'd)

Jeffrey P Poirrier, WA
Jeffrey Quinney, WA
Jeffrey S & Turner, Katherine R Lawrence, WA
Jeffrey S Pantley, WA
Jeffry & Theodore Dunnington, WA
Jemma Crae, OR
Jenelyn M Wessler, OR
Jenness Mann, OR
Jennifer & Scott Hamblen, WA
Jennifer Anne Sakchalathorn, CA
Jennifer Risner, WA
Jennifer Short, WA
Jennifer Tice, WA
Jennifer Torgison, WA
Jennimae Hillyard, WA
Jenny YoungSeidemann, OR
Jerald L & Yumi T Roth, WA
Jeramie J & Angela M Ausmus, WA
Jeremiah D Pierucci, WA
Jeremy & Renee Evje, WA
Jeremy & Rivera, Ruben & Rivera, WA
Jeremy & Shanna Visser, WA
Jeremy A & Joanne D Ehrmantrout, WA
Jeremy J & James R Herbel, WA
Jeremy Kallerman, WA
Jeri K Sargent, OR
Jerri Eilert, WA
Jerrol Smerek, WA
Jerry & Brandy Huang, WA
Jerry & Brenda Ng, WA
Jerry & Pamela Gomes, WA
Jerry D Mooberry, WA
Jerry N Sturglaugson, WA
Jerry Osness, WA
Jeryce Russell, OR
Jess & Carol Workman, WA
Jesse A & Maren L Kreun, WA
Jessica Schwabe, WA
Jessie G & Andrea N Napenias, WA
Jessie Thomas, OR
Jesus Martinez Diaz, WA
Jian Zhong & Yuehua, Lin Tang, WA
Jill Hartman, WA
Jill J. Walter & Deann Goodspeed, WA
Jill Rouse, WA
Jill Seidenstein, WA
Jim Burnett, OR
Jim Capellen, OR
Jim Hawk, WA
Jim K & Lani L Lok, WA
Jim Santee, OR
Jim Scheller, OR
Jim Stoffer, OR
Jim VonStein, OR
Jim Zaleski, OR
Jimmie L & Patricia H Richardson, WA
Jimmie Y & Lynne Inouye, WA
Jimmy Beckwith, OR
Jimmy D & Debbie Francis, WA
Jisook Ri Chun & Young K. Chon, WA
Jo Hannan, OR
Joan R. Buckmaster, WA
Joann Muller, OR
Joanna Connolly, OR
Joanne Gregory, CA
Joanne Shih, WA
Joao Karlos Vilca Soto, WA
Jody McCaffree, OR
Jody Rodgers, WA
Joe A & Lora M Riley, WA
Joe E Wishcamper, WA
Joe Hengel, OR
Joe Kane, WA
Joe Nelson, WA
Joe R Hutchings, WA
Joel A & Michelle M Zehe, WA
Joel Lucia, OR
Joel Myers, OR
Joelle Mauthe, WA
John & Asako Voorhees, WA
John & Catherine Lenac, WA
John & Christine Rosenquist, WA
John & Cynthia Fuller, WA
John & Elizabeth Davidson, WA
John & Gretchen Corbin, WA
John & Heidi Ellis, WA
John & Joanne Parmley, WA
John & Linda Larsen, WA
John & Lynne Norton, WA
John & Marta Tankersley, WA
John & Mary Faure, WA
John & Michelle Dunn, WA
John & Michelle Scoggins, WA
John & Sheila Barlow, WA
John & Teri Parks, WA
John A & Donna P Hunter, WA
John A & Joan A Dragavon, WA

Individuals (cont'd)

John A & Joyce A Burns, WA
John A Rodrigue, WA
John A Surbert, WA
John A. Williams; & J. M. Fulton & L. Edward Strobel, WA
John Angell, AK
John C Taber, OR
John D Bargen, WA
John D Feldman, WA
John D Ferris, WA
John D. & Crystal R. Hagel, OR
John Demaria, OR
John Dervin, WA
John DuBois, WA
John E & Chun Mien Christian, WA
John E & Lynn E Kilgus, WA
John E & Sheri L Lawson, WA
John E Mitnik, WA
John E Scofield, WA
John Edwards, WA
John H & Allene L Rodenberg, WA
John H & Nancy E Dahlen, WA
John H Pitman, OR
John H. Korpi, AK
John Hahn-Francini, OR
John I & Gloria Kountz, WA
John J & Brigett T I Hall, WA
John J Christiansen, WA
John J. & Lisa K. Bluff, WA
John Jordan, OR
John Jr. (Heir) Taggart, OR
John K Tolonen, WA
John K. Hoxeng & Sonja L. Prince, WA
John Kaakinen, OR
John Kalander, OR
John Linzee, WA
John Little, OR
John M & Carol A Hamlot, WA
John M & Nancy Graff, WA
John M Corwell, WA
John M., III Myles, WA
John Magnuson, WA
John O'Neil, WA
John Oscar, Jr & Kirsten Marie Morton, WA
John P & Kathleen A Corrigan, WA
John P Jeroue, WA
John P Wimberley, OK
John Paul, OR
John R & Delores Pettitt, WA
John R Urback, WA
John Rogantine, OR
John Rogantine, OR
John S & Lynn G Burch, WA
John S & Toni Brender, WA
John Stelfox, WA
John W & Judith A Bogsch, WA
John W & Rosemary B Allen, WA
John Washington, OR
John William Kaakinen, OR
John, Jr Soltis, WA
Johnny E & M Sharon Swartz, WA
Johnson Revocable Trust, WA
Jon B. Thomas, OR
Jon C & Cynthia J Flinchbaugh, WA
Jon C & Joyce C Evans, WA
Jon D & Evanne B Aarstad, WA
Jon Hornback, WA
Jon Koriagin, OR
Jon Madian, WA
Jon Shelley, OR
Jonathan & Angela Teano, WA
Jonathan A & Maegen A Blue, WA
Jonathan Floyd, WA
Jonathan G & Mary J Dinsmore, WA
Jonathan H & Elizabeth Clark, WA
Jonathon A & Kimberly Shipman, WA
Joni M Bragg, WA
Jon-Michael & Caroline Terlaje, WA
Jorge G & Barbara J Tirado, WA
Jose A Trujillo, WA
Jose Acosta-Jaquez, MI
Jose Garcia, WA
Jose Mendoza, WA
Jose R & Armida Mayorquin, WA
Josef Gault, OR
Joseph & Karen Hurzeler, WA
Joseph & Kathleen Spadaro, WA
Joseph & Suzette Yoshitake, WA
Joseph B & Theresa Indovina, WA
Joseph Bodmer, WA
Joseph C. & P. F. Patterson, WA
Joseph Christen, OR
Joseph Deutsch, WA
Joseph Gymkowski, OR
Joseph L & Kelley L Bremgartner, WA
Joseph L & Margie R Parker, WA
Joseph Lee Rex & Bern Hoover, WA
Joseph M & Janet E Macher, WA

Individuals (cont'd)

Joseph M & Janice M Emery, WA
Joseph Michael Haggren, OR
Joseph P & Roberta L Schlosser, WA
Joseph Riddell, WA
Joseph S & Susan P Powell, WA
Joseph T. & Annette T. Leclair, WA
Joseph, Jr Santilli, WA
Josephine Luke, WA
Josh Cole, OR
Joshua & Walker, Adrienne Mark, WA
Joshua Alan & Beth Alison Smith, WA
Joshua C Searle, WA
Joshua D & Nicolette E Marzolf, WA
Joshua Lomen, WA
Joshua Montero, WA
Josie Peper, OR
Joy Arianashira, WA
Joyce C Beahan, WA
Joyce Law & David Faires, WA
Joyce M Driscoll, WA
Joyce W Teng, WA
Joyce Weir, WA
Jr & Tressa Greene Trust Clarence, WA
Juan J & Vazquez, Deyana M Hernandez, WA
Juan, Jr & Georgette M. Bandin, WA
Juanita Rosene, OR
Judith A Hart, WA
Judith A Rivera, WA
Judith B. Kocer, WA
Judith Grote, WA
Judith Hart, WA
Judson & Karil J Branch, WA
Juel M. Smith & Ronald L. Norton, WA
Jugraj & Randhawa Singh, WA
Julia Bondi, OR
Julia C Partlow, OR
Julia Herrin Reed, WA
Julia Hurd, WA
Julianne Hall, OR
Julie E Hillend-Jones, WA
Julie K Larson, WA
Julie Whitacre, WA
Juliet Ching, OR
Juliette C Smith, WA
Julio & Phoebe Mendez, WA
Julio Torres, WA
June Buma, WA
June C Stinson, WA
Jurgen Exner, WA
Justin & Erin Gillenwater, WA
Justin & Michelle A Harries, WA
Justin & Mindy Byran, WA
Justin & Raquel Onedera, WA
Justin T Kenney, WA
K C Heckenberg, OR
K Jane Mccassey, OR
K Sweeney-Easter, WA
Kae Moe, WA
Kalyanaraman & Sangeet Prasad, WA
Kanishk & Neha Panwar, WA
Kannan Choodamani & Aruna Kannan Iyer, WA
Karen Calvin & Robert E., Jr Woodard, WA
Karen L Rodewald, WA
Karen Levine, OR
Karen M & Michael A Thomas, WA
Karen M Haverkate, WA
Karen Moody, WA
Karen Pehoushek, WA
Karen Shawcross, OR
Karen Whalen, WA
Karen Wickham, OR
Kari & Ruth Ann Hakso, WA
Kari Kay Boyle, WA
Karl H & Beth M Deissler, WA
Karl M Ludwig, WA
Karl Piller, OR
Karl R Sieger, WA
Karla C Pineda, WA
Kate Joyce Cooper, OR
Katherine & Eric and Brown, Randall Gudgel, WA
Katherine & Salvador Santos, WA
Katherine A & Nygaard K & R E Selsor, WA
Katherine Batts, WA
Katherine Foldes, OR
Katherine Kauzlarich, WA
Katherine Mast, OR
Katherine Mayben, WA
Katherine Riddle, WA
Kathi Merrit, OR
Kathleen A Erholm, WA
Kathleen A Seehorn, WA
Kathleen C Carrera, WA
Kathleen Forcier, WA
Kathleen Hall, WA
Kathleen Ing, WA
Kathleen Kelly, WA
Kathleen Meagher, OR

Individuals (cont'd)

Kathleen Mitchell, WA
Kathleen Richardson, WA
Kathleen Robson, WA
Kathleen Sullivan, OR
Kathryn Levine, OR
Kathryn M Barnard, WA
Kathryn R Wayne, WA
Kathy Bowen, OR
Kathy Greysmith, OR
Kathy Johnson, WA
Kathy L Saka, WA
Kathy M Boyll, OR
Kathy Su-Tsow, WA
Kathy Swingle, WA
Kathy Wilson, WA
Katie Whittier, WA
Kay Kendall, OR
Kay Kinsley, OR
Kay L Hoffman, WA
Kay M Lyon, WA
Kay Peterson, OR
Kayla & Alex Hill, WA
Kees Kolff, WA
Keith & Charlyn Anderson, WA
Keith A Terry, WA
Keith D Zaichkin, WA
Keith Hay, CA
Keith J & Karen J Boon, WA
Keith Mason, WA
Keith Morey, OR
Keith Neal, OR
Keith Strader, WA
Keith W Lofstrom, WA
Kelly Glenn & Thaddeus Singer, WA
Kelly Paige, OR
Kelvin G & Tracie T Lung, WA
Kelvin Lindren, WA
Kemper Family Living Trust, Matthew & Delores Schouten, OR
Ken & Gena Unser, WA
Ken & Joomi Shou, WA
Ken & Rise A Crowl, WA
Ken Garman, WA
Ken R & Linda C Solberg, WA
Ken Whipple, WA
Kendrick Simila, OR
Kenneth & Linda Carlson Schroeder, WA
Kenneth B. & Sandra L. Ness, WA
Kenneth Breckwoldt, WA
Kenneth Brown, OR
Kenneth Cambley, WA
Kenneth D. Smith, WA
Kenneth G & Lisa A Haynes, WA
Kenneth J. Hicks, OR
Kenneth L & Gloria Crocker, WA
Kenneth L & Janna L Stevens, WA
Kenneth L & Kimberly L Courser, WA
Kenneth M & Carlaine E Downs, WA
Kenneth R & Susan F Geschwint, WA
Kenneth R. Ampel, OR
Kenneth Rask, OR
Kennie Lee Jr & Adrienne L Cotton, WA
Kent & Maureen Callen, WA
Kent A & Heidi L Kamphouse, WA
Kent J Preston, WA
Kent S & Gretchen M Stepaniuk, WA
Kenton C. Barker & Megan P. Condon, WA
Keri Callahan, WA
Kerie M & Aaron A Swepston, WA
Kerry K. Harper & T. C. Goff, MO
Kerry Phibbs, WA
Kerry W & Debrah J Cruze, WA
Kerry Warren, WA
Keshuang & Zhang, Caifeng Shen, WA
Kevin & Cherisse Chapman, WA
Kevin & Gallo, Patti Murphy, WA
Kevin A & Pamela Wessel, WA
Kevin A & Sharon L Gansneder, WA
Kevin A & Victoria L Cleveland, WA
Kevin B & Carole Bullard, WA
Kevin C & Jackie L Stone, WA
Kevin Gundersen, WA
Kevin J & Shelley A Walker, WA
Kevin J & Tia McGreevy, WA
Kevin Johnson & Ashli D. Tyre, WA
Kevin K & Erica L Ford, WA
Kevin Kern, WA
Kevin Leja, WA
Kevin P & Heather M Joyce, WA
Kevin P & Susan P Sullivan, WA
Kevin Schmidt, WA
Kevin Slaughter, WA
Kevin T Seward, WA
Kevin Wickes, WA
Khuong & Nguyen, Jaclyn Le, WA
Kiernan Hodge, OR
Kim & Lewis, Jimmy Merow, WA

Individuals (cont'd)

Kim A & Paula Y Crumrine, WA
Kim Chesley, WA
Kim L Scott, WA
Kim Weers, WA
Kimberly French, WA
Kimberly M & Edward A Page, WA
Kimberly Olds-Craig, WA
Kimberly Serrano, OR
Kirati & Ladda Mankongvanichkul, WA
Kirk & Sarah Reid, WA
Kirk E Hyatt, WA
Kirk H Prindle, WA
Kirk R. Nortman, OR
Kirsten E. Esvelt, WA
Kit Watts, OR
Knutson Testamentary Trust & Mark C Knutson, WA
Krisha Davis, WA
Kristie L Terrio, WA
Kristin Barber, WA
Kristin L Joachim, OR
Kristina & Chris B Newcomb, WA
Kristine I & Daniel B Borden, WA
Kristofer & Stephanie Sparks, WA
Krystal M. Erickson & Jory L. Clark, WA
Kuhlman Louis J, WA
Kurbanali H Merchant, WA
Kurt & Becky McKibben, WA
Kurt & Betsi Stich, WA
Kurt A & Susan H Hamke, WA
Kyle Hatfield, WA
L Daloz, WA
L. A. Kimmet & Brian E. Roberson, WA
L. K. Althouse, OR
L. R. Lofgren & H. E. Truitt, WA
Ladonna & Kummerfeldt, Ryan Meadows, WA
Lana Massa, WA
Lana Maupin, OR
Lance & Tina Larsen, OR
Langley Family Trust, Mark Langley, WA
Lanny H. & Jill S. Cawley, WA
LaRee Johnson, OR
Larry & Betty Pekkola RLT (Trustees), OR
Larry & Holly Mahan, WA
Larry & Kelsey Dungan Rand, WA
Larry D Chinn, WA
Larry D Drawhorn, WA
Larry D. & Margaret Trudeau, WA
Larry Dale & Kathleen E Loveall, WA
Larry G & Kathleen S Hittle, WA
Larry G & Mary Harbison, WA
Larry Gravely, WA
Larry K & Sandra D Albertson, CO
Larry L & L Dianne Pletcher, WA
Larry Lovelady, OR
Larry M Wasisco, WA
Larry M. & Debra L. Lowe, WA
Larry Mark Bergeson, OR
Larry R Williamson, CA
Larry S. Ahl, OR
Larry Scott McMillan, HI
Larry Steele, OR
Larry Troy, WA
Larry W & Sally S Omo, WA
Larry Williams, OR
Laura Alves, OR
Laura C Cassey, WA
Laura Golinod Lavato, OR
Laura Leigh Brakke, WA
Laura VanFleet, OR
Laurence W. Brown, WA
Laurie B Porter, WA
Laurie Doscher, OR
Lavon D & Mary M Woodard, WA
Lawrence & Laura Johnson, WA
Lawrence A & Patricia A Jones, WA
Lawrence D James, WA
Lawrence M Thorpe, OR
Lawrence R & Elaine Haft, WA
Leah Matheson, OR
Lee & Susan Boevers, WA
Lee B & Natasha Parker, WA
Lee Labrash, WA
Lee Miller, WA
Lee Powell & Joyce Gillingham, WA
Lee Roy J Engler, WA
Lee Roy Seymore, WA
Lee Talbott, OR
Lee Vern Truman, WA
Lee Walkling, WA
Lee Wilson, OR
Leith Macfarlane, OR
Leland Seibert, OR
Lemec & April Pierre, WA
Lemoine Radford, WA
Lena Sayers, WA
Lenoir K Hayward, OR
Lenora & Guy Anderson, WA

Individuals (cont'd)

Lenora M. Anderson, WA
Leo L & Diane Kimmet, WA
Leon Chow, CA
Leon J Lara Dolores, WA
Leon T & Frances S Matz, WA
Leon Thrane, WA
Leona Crow, WA
Leonard & Linda L Ramsdell, WA
Leonard Brock, WA
Leonard H & Leila R Brickey, WA
Leonard Hockley, OR
Leonard M Roughgarden, WA
Leonard Maslanka, OR
Leonard P & Patrice A Vincent, WA
Leonard V & Lorraine E Simpson, WA
Leroy B & Laurel A Fay, WA
Leroy K. & Joyce A. Bruenn Trust, Leroy, WA
Lesia Montgomery-Toms, WA
Leslea Steffel-Dennis, WA
Lesley A & Keller, Benja Colby, WA
Leslie A Methe, WA
Leslie E Bailey, WA
Leslie E Baker, NV
Leslie J Patterson, WA
Leslie Myrick, WA
Leslie Patrick, WA
Leslie Sonnergren, WA
Lester A Slead, WA
Lester H Greene, WA
Lester Rowles, WA
Levi Perkins, OR
Lewey Brown, WA
Lewis & Diane & Hood, Daryl D Lopes, WA
Lewis Tiffany, WA
Li Huan & Wei Wang, WA
Lijah K Manus, WA
Lila Mahan, WA
Lillian Buchanan, WA
Linda & Robert H Burns, WA
Linda B. Streitfeld, WA
Linda Cleckler, WA
Linda Harkness, Wa
Linda Hruby, WA
Linda Kirk, WA
Linda L DeSitter, OR
Linda R. Adye & Andrew B. Whitish, WA
Linda Siverts, WA
Linda Sloane & Dwain D. Dabney, WA
Linda Stiles-Taylor, OR
Linda Thompson, OR
Linda Versteeg, OR
Lindsay A Jensen, WA
Linnea H. Evans, WA
Lisa A Britto, WA
Lisa Bull, WA
Lisa Dekker, WA
Lisa Fleek, WA
Lisa Karas, WA
Lisa Kelsey, WA
Lisa M. Richards & David M. Richards, WA
Lisa M. White & Kristofer A. Corning, WA
Lisa Malland, WA
Lisa R Resser, WA
Lisa Stevens, WA
Lisbet S Johnson, WA
Liu Yen Ping Chiao, WA
Llory Boynton, WA
Lloyd & Gail Wright, OR
Lloyd C Dally, WA
Lloyd L Walker, WA
Logan Rowland, WA
Lois C Bush, WA
Lois Eagleton, OR
Lois J Perrett, WA
Lois Kieffaber, WA
Lois Maxine Lee, WA
Lonn C Sweeney, OR
Lonnie G & Lucille A Brown, WA
Lonnie K Sargent, WA
Lonny J Wolk, WA
Loraine M Dennett, WA
Loren & Bonnie Gilderoy, WA
Loren J & Shelli J Ackerman, WA
Loretta Orosz, OR
Lori Ann Disparte Carter, WA
Lori L. & Michael K. Hogarty, WA
Lorraine J Holcomb, WA
Lorraine N King, WA
Lorree Gardener, WA
Lorrie L Massie, WA
Lorrie M Wood, WA
Louis & Stefanie Mendenhall, WA
Louis I & Emily M Duran, WA
Louis Kloewer, WA
Louise Vinuya & Jeffrey Shands, WA
Low Alexander, OR
Luanna Iverson, WA

Individuals (cont'd)

Luanne & James Caylor, WA
Lucas G & Kirstie A Teeter, WA
Luciguela E King-Smith, WA
Lucile Brook, OR
Lucille M Gardner, WA
Lucy Mead, OR
Luke J & Brenda L Goethals, WA
Lulu Heavenrich, OR
Lyle E & Vicky J Fox, WA
Lyn Mattei, OR
Lynda M & Donald T McDaniel, WA
Lynn C Axtell, WA
Lynn F Cooke, WA
Lynne Treat, WA
M D Shively, WA
M Ellen Moon, WA
M Johantgen, WA
M Michael Slama, CA
M. L. Tompkins & John F. Forgey, WA
Madeline Kokes, OR
Madeline Murphy, OR
Magdalena S Trotter, WA
Mahlon D. Heller, CA
Makarand & Sonali Bhagwat, WA
Man Pham, WA
Manila M Cannon, WA
Manish Ajmera, WA
Manuel & Zorel Yu, WA
Marc & Elizabeth Provencher, WA
Marc P Mattila, WA
Marc R & Makisha L Norwick, WA
Marc Ratner, OR
Marc Vigna, WA
March Twisdale, WA
Marcia Gervin-Gillyard, WA
Marcia L Nanea, WA
Marcie C. Kahler & James C. Davis, WA
Marga Stanley, OR
Margaret & Brian Pomeroy, WA
Margaret A Maxwell, WA
Margaret C McNees, WA
Margaret Fourhman, WA
Margaret J Steeves, WA
Margaret J. Worthman, WA
Margaret L Larson, WA
Margaret Lemberg, WA
Margaret M Denison, OR
Margaret Ross, WA
Margaret Thompson, OR
Margarita Calderon & Eduardo Dominguez, WA
Margie J. Couch & Antonio E., Jr Peralta, WA
Margitta M Schulz, WA
Margot Fetz, OR
Maria I. Gonzales & Juan A. Daza, WA
Maria Isabel Cuevas & Ricardo Bramila, WA
Mariah Lindgren & Jacob Tilton, WA
Marianna Redd, OR
Maricres M & Clinton D Talley, WA
Marie Stuckey, OR
Marily D A Berko, WA
Marilyn Levin, OR
Marion M Barr, WA
Marisol L & Sean P Brice, WA
Mariya Yagodina, WA
Marji Westwood, WA
Marjorie A Noren, WA
Marjorie Cogan, WA
Marjorie, Tedrick- Turner, WA
Mark & Albany Walters, WA
Mark & Cynthia Harp, WA
Mark & Jennifer Balentine, WA
Mark & Judy Franklin, WA
Mark A Gallegos, WA
Mark Anderson, WA
Mark B & Diane A Satterlee, WA
Mark B. & Gloria G. Cutler, WA
Mark C & Kim T Hammer, WA
Mark D & Heidi D Fuller, WA
Mark D Farman, WA
Mark E & Jane R McDaniel, WA
Mark E Cunningham, WA
Mark E. & Carol A. Schulz, WA
Mark E. Rosin, WA
Mark Eagleton, OR
Mark F & Kimberley E Nygard, WA
Mark H Hickman, WA
Mark Hedin, WA
Mark J Gilbert, WA
Mark L & Karin A Hettel, WA
Mark R & Catherine A Nonhoff, WA
Mark S Edwards, WA
Mark Sutton, WA
Mark T Unno, OR
Markus & Megan Charboneau, WA
Marlon Montano, OR
Marni K McGuire-Elhard, MT
Marshall C., Jr Jones, WA

Individuals (cont'd)

Marshall T & Cynthia R Blansfield, WA
Marta Saarheim, OR
Martha Sucher, WA
Marthan Walker, NV
Martin A Nance, WA
Martin Ed Wise, WA
Martin Fox, WA
Martin Nygaard, OR
Martin Schroeder, OR
Martin Velez, OR
Marty & Bian, Knitter Griffith, WA
Marty E Belfield, WA
Marvin A & Glenda B & Vreugdenhil, John B Vreugdenhil, WA
Marvin A. & G. Bernice Vreugdenhil, WA
Marvin C & Saralee Smith, WA
Mary A McCann, WA
Mary Ann Brown, OR
Mary B Hutson, WA
Mary Bennett, WA
Mary Blake, OR
Mary C. Darling & Mark D. Langen, WA
Mary Cody, OR
Mary Colton, WA
Mary E McKay, WA
Mary E. Swinnerton, OR
Mary F Slaight, WA
Mary Flores, WA
Mary Gabriele, OR
Mary Gaughan, WA
Mary Jane Gray, OR
Mary K Weller, OR
Mary Larsen, WA
Mary Lasswell, OR
Mary Lou SanBlise, OR
Mary P. Lang, WA
Mary P. Scully, OR
Mary Smith, OR
Mary VanDer Veen, WA
Maryann Aborqui, WA
Mathew & Nicole Zemanek, WA
Mathew J & Shawna M Fuller, WA
Mathew J &Robyn N Eldridge, WA
Matt & Tok Nary Swart, WA
Matt Hodson, OR
Matt Mathews, OR
Matthew & Airen Perry, WA
Matthew & Caitlin Schweyen, WA
Matthew & Karli McIver, WA
Matthew & Lisa Woicik, WA
Matthew & Ti Fan Bucher, WA
Matthew A & Angela I Peart, WA
Matthew D & Nicole L Newsome, WA
Matthew H Marksbury, WA
Matthew Hayrynen, WA
Matthew J Kline, WA
Matthew L & Donald F & Judith M Olson, WA
Matthew M & Cindy Hamilton, WA
Matthew P Bracking, WA
Matthew S & Jessica M Weber, WA
Matthew Schiffman, OR
Maug & Bo Ra Kim, WA
Maureen Dooney Mosley, OR
Maureen F. Knutson, WA
Maureen L Medford, WA
Maurine & Michael Corcoran, WA
Max Cameron, WA
Maynard & Charlotte Trust Westmark, WA
Megan & Eric M Hall, WA
Mehrdad Ghaffari, WA
Melanie Beattie, WA
Melinda Blackwell, OR
Melinda Essig, WA
Melinda Flaig, WA
Melinda R Lytle, WA
Melissa & Jon Mortensen, WA
Melissa A Wallace, OR
Melody Williamson, OR
Melony S & Aaron S Cannata, WA
Melvin (Trustee) Hartill, OR
Melvin R & Laurie A Rees, WA
Melvin Ulven, OR
Merle & Timothy Miller, WA
Merlin G Rev Liv Trust Bowman, OR
Merry V. Young, OR
Meryle A Korn, OR
Micaela Moore & Michael Muhammad-Powell, WA
Michael & Brenda Keith, WA
Michael & Carli Gilbert, WA
Michael & Cathy Wojtowicz, WA
Michael & Cindy Smith, WA
Michael & Connie Wolffe, WA
Michael & Denise Hines, WA
Michael & Gwendolyn More, WA
Michael & Helen A Milyo, WA
Michael & Kathleen Miele, WA
Michael & Kathleena Gomes, WA
Michael & Katie Zinkgraf, WA

Individuals (cont'd)

Michael & Kimberly C. & Chesley D. & Jackie D. Tippery, WA
Michael & Laurie Debus, WA
Michael & Lesa Springer, WA
Michael & Lisa Ahlen, WA
Michael & Lori Bonifant, WA
Michael & Patty Haukenberry, WA
Michael & Velva J Lytle Wynne, WA
Michael A & Angela Parker, WA
Michael A & Kathleen M Essig, WA
Michael A & Mariye Ota Cina, WA
Michael A & Sandro D. Moscone; Teresa Grage & Stewart Metcalfe, WA
Michael A & Sharon L Dahl, WA
Michael A Sears, OR
Michael Armstrong, WA
Michael Ashe, WA
Michael Aubele, TX
Michael D & Bianca Lemmons, WA
Michael D & Elizabeth Swanson, WA
Michael D & Judy V Flanagan, WA
Michael D & Sharon M Fogarty, WA
Michael D & Sherri L Kingsley, WA
Michael D & Susan M Harris, WA
Michael D Anderson, WA
Michael D McDaniel, WA
Michael D Yandl, WA
Michael E & Amy L Shappell, WA
Michael E & Theresa Grijalva, WA
Michael F Pfister, WA
Michael F Seibel, WA
Michael G & Elizabeth Bejarno, WA
Michael G. & Merrily M. Sloan, WA
Michael H & Evelyne H Kennedy, WA
Michael H & Kristi A Keene, WA
Michael Hampel, WA
Michael J & Dianne E Grant, WA
Michael J & Elaine S Moshcatel, WA
Michael J & Kathleen A Hassur, WA
Michael J & Kristine L Duncan, WA
Michael J & Lissa M Smith, WA
Michael J & Pamela A Degrenier, WA
Michael J & Wendy M Del Sarto, WA
Michael J Amrine, WA
Michael J Devine, WA
Michael James Lull, WA
Michael John Dragness, WA
Michael K & Karen G McNamara, WA
Michael K Wolf, WA
Michael Krumper, OR
Michael L & Sarah A Dotson, WA
Michael L & Wendy A Young, WA
Michael L Roesch, WA
Michael Lombardo, WA
Michael Mcgee, WA
Michael O'Neal, WA
Michael Osborn, WA
Michael P & Patricia G Anderson, WA
Michael P & Wendy T Woodward, WA
Michael P Tipps, WA
Michael P Vernon, WA
Michael P Wisniewski, WA
Michael P. & Amy J. Williams, WA
Michael R & Susan G Cross, WA
Michael R. Boehmer & Daniel C Lindstrom, WA
Michael R. Reed, OR
Michael Robinson, OR
Michael S & Carrie A Gove, WA
Michael S & Lisa N Alexander, WA
Michael Slaughter, WA
Michael Snyder, WA
Michael Sturges, OR
Michael Swift, NV
Michael T & Joan K Watson, WA
Michael T Wooding, WA
Michael W & Barbara B Hallum, WA
Michael W & Briana Ethington, WA
Michael W. & Bonita I. Sours, WA
Micheal D & Claudia M Ussery, WA
Michela Bona & Davide Bertolo, WA
Michele M Durkee, WA
Michele Mennett, OR
Michele VanRiper, OR
Michelle & Ream, Jody Barnett, WA
Michelle Barnes, OR
Michelle Debell, WA
Michelle Downing, WA
Michelle J & Joshua B Gunia, WA
Michelle L Darby, WA
Michelle L Shambo, WA
Michelle L. Duhaime & Richard D. Duhaime, WA
Michelle M Evans, WA
Michelle Rothbauer, WA
Michelle Stewart, WA
Mickey W & Kathy Ann Askew, WA
Miguel & Montes Alicia A Amaral, WA
Miguel Tadeo Jimenez, WA
Mike & Debbie Sands, WA

Individuals (cont'd)

Mike J & Nolly C Bartos, WA
Mike Kennedy, OR
Mike/Chris Conroy, WA
Mildred L Lange, WA
Miles Martin, OR
Mitch Pyle, WA
Mitchell A Noftsger, WA
Mitchell Ross, OR
Mitzi Loftus, OR
Miyuki Peterson, WA
Mohammad R & Nahid, Hosseini Sianaki, OR
Molly Brown, OR
Molly Oberbillig, WA
Molly Onkka, WA
Molly Palmer, WA
Monica Taylor, OR
Monty J & Fadila Brown, AE
Monty L & Margaret Ann Price, WA
Monty R Perrott, AZ
MoonHill Mushrooms LLC, WA
Morgan Family Trust, Tom & Leah Morgan, WA
Mr. David S Gill, CA
Ms. Charlotte Dinolt, OR
Ms. Wendy Loren, OR
Muralikrishnan V & Edavalath, Sunitha T Puthanveetil, WA
Murugesan S & Nirma Subramani, WA
Muschi Mayflower, OR
Mychael A & Wyn U Ta, WA
Myron & Priscilla Zwadlo, WA
Myron A & Karin A Struck, WA
Myrtle M Specht, WA
Mysti L & Martin R Andrews, WA
N. C. Caldwell & Thomas C. Lafond, WA
Nadine L. Vanoverbeke & David J. Lord, WA
Nan Ellen Haberman & David Ingles Brock, WA
Nancy A Newell, WA
Nancy Brock, OR
Nancy Ceasar, OR
Nancy E. Jackson & Bruce R. Healy, WA
Nancy Earnst, WA
Nancy Ledgerwood, OR
Nancy Nelson, OR
Nancy P. White, WA
Nancy Phillips, OR
Nancy Smith, WA
Nancy Spaan, OR
Nanette Leaman, WA
Naomi N. Fellows, OR
Nardito N Ferrer, WA
Natalie Mercer, WA
Natalie Mercer, WA
Nathan A & Janice L Wiggins, WA
Nathan D & Christina Scherer, WA
Nathan Scott Lee, OR
Nathan Visan, WA
Nathaniel & Stephanie Kenison, WA
Neal & Serena Friedman, WA
Neal E & Shannan D Wooten, WA
Neal Stiffler, OR
Ned Petrich, OR
Neenos Rees, WA
Neil & Kimberly Pedersen, WA
Neil R & Patricia E Gansler, WA
Nelson A. & Pamela I. Graham, WA
Nelson A. Graham, WA
Nelson H Harano, WA
Nhu Nguyen, WA
Nicaela A. Hart & Gregrey R. Hemenway, WA
Nicholas & Courtney Marg Brunelle, WA
Nicholas & Danielle Lashbaugh, WA
Nicholas B & Theresa A Galash, WA
Nicholas Condon, WA
Nicholas J & Colleen M Volk, WA
Nicholas Singer, OR
Nick & Janet Sprynczynatyk, WA
Nick Engelfried, OR
Nick Galaday, OR
Nicole & Turrie, Matthew Berry, WA
Nicole Hughes, WA
Nicole M Martin, WA
Nikolai Kopets, WA
Nikolay & Olga Verimeyev, WA
Nita & Kenneth Waller, WA
Norman C Grier, WA
Norman C. Waddell, OR
Norman G & Lucille S Araki, WA
Norna M & Michael J Luquette, WA
Nowell King, OR
O. Fred Eckhardt, OR
Olaf L Olsen, WA
Olga & Grigory Tereshchenko, WA
Om Prakash & Yadav Niti Ravi, WA
Ona Elizabeth & Douglas William Nighswonger, WA
Ordie & Pamela Butterfield, WA
Orville D Esteb, WA
P.T. Baldwin, OR
Paige Maks & Shannon Anderson, WA

Individuals (cont'd)

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Panesko Trust, WA
Paranthaman Sundaravadivelan, WA
Pascal & Heather Mansy, WA
Pat Arnold, WA
Pat Corcoran, OR
Patrice Pelland, WA
Patricia A. Ellis, OR
Patricia A. North, OR
Patricia Ann Stevens, WA
Patricia Carpenter, WA
Patricia Doheny, WA
Patricia Emerson, VA
Patricia J Fabian-Chavez, WA
Patricia K Hayes, WA
Patricia Kellogg, OR
Patricia Kennedy, OR
Patricia Knowles, NV
Patricia M & Danial R Clay, WA
Patricia M Miller, WA
Patricia Otto, WA
Patricia Terranova, OR
Patricia Thoe, WA
Patrick & Jennifer O'Leary, WA
Patrick & LaDawna Clerget, WA
Patrick & Michael Dooney, OR
Patrick & Sharon Hardy, WA
Patrick A. & Erica L. Griffith, WA
Patrick C & Verna M. Dessert, WA
Patrick D Clark, WA
Patrick G & Kathleen Rua, WA
Patrick J Gu, WA
Patrick J., Sr O'Brien, WA
Patrick K McKillip, WA
Patrick M & Irma J Morgan, WA
Patrick M Ryan, WA
Patrick M. & Cheri A. McClellan, WA
Paul & Jennifer Tusler, WA
Paul A Hahn, WA
Paul C. Crocker, OR
Paul D Johnson, WA
Paul E & Vesta L Gibbard, WA
Paul E. Staub, OR
Paul J. Lutzenberger, WA
Paul Johansen, WA
Paul Johnson, WA
Paul L & Karen J Tegantvoort, WA
Paul M & Tatiana J Johnson, WA
Paul M., II & Sonia G Wright, WA
Paul Pohlreich, WA
Paul R & Serena S Messner, WA
Paul R. & Grace I. Shaw Hill, WA
Paul S Cho, WA
Paul Sansone, OR
Paul Thompson, WA
Paula M Cook, WA
Paula Mackrow, WA
Paula Springer, OR
Paulette Edmiston, WA
Pauline M Weber, WA
Paval A & Olga Magdalin, WA
Pavel &Chelsea Buzek, WA
Peg ElliottMayo, OR
Peggi Erickson, WA
Per Holten-Andersen, OR
Perry P Corwin, WA
Pete II & Sheri Jorgensen, WA
Peter & Janis L Pikulin, WA
Peter & Tin Ness Som, WA
Peter A Blane, WA
Peter E & Kristin M Carlson, WA
Peter Henry, WA
Peter J & Alejandra G Decruz, MS
Peter J. III Szambelan, OR
Peter M & Frances A Crosby, WA
Peter S Ogden, WA
Peter Truax, OR
Peter W. & Susan Janicki, WA
Phil Goldsmith, OR
Philip & Eileen Laskowski, WA
Philip & Linda Bye, WA
Philip & Viola Barber, WA
Philip A & Joyce E Marick, WA
Philip B Korthius, WA
Philip J & Kathleen E Demaree, WA
Philip M & Fanny Y Yee, WA
Philip Mahony, OR
Philip S Erikson, WA
Phillip & Gorham, Pamela Mills, WA
Phillip B Halloran, WA
Phillip C Johnson, WA
Phillip J & Sarah A Moss, WA
Phyllis Borden, WA
Piper Henry-Keller, WA
Polizois & Tracey Johnston, WA
Porter B Lombard, OR

Individuals (cont'd)

Porter H & Jacquelyn L Sigler, WA
Preston & Jennifer Thorne, WA
Preston Malzahn, WA
Qian & Yoke Wong Zhang, WA
Qian & Yoke Wong Zhang, WA
Quan & Kristina Wang, WA
Que Areste, WA
Quentin L & Molly L Clark, WA
R Jay & Brenda Allred, WA
R Wayne & Anne Redington, WA
R. D. Edfeldt & B. V. Steussy, WA
R. Duncan MacKenzie, OR
R. Grant, Jr & Vicki A. Levens, WA
R. Isaacson, WA
R. John Spade, WA
R. W. & Annabelle Bolduc, WA
Racheal A Bell, WA
Rachel Gilbert, WA
Rae Anne Miller, WA
Rajbir & Rupinder Raju, NJ
Ralland L Wallace, WA
Ralph & Marlene Riden, WA
Ralph & Victoria L Willey, WA
Ralph David Jones, WA
Ralph L Edwards, WA
Ramon Del Puerto, WA
Randall B & Sonna L Eader, WA
Randall C & Sheryl A Arens, WA
Randall D & Melanie J Hanson, WA
Randall Frable, WA
Randall Henderson, OR
Randall J. & Deborah L. Vaughter, WA
Randall N. Parks, WA
Randolph A Peters, OR
Randy & Alberta Cobb, WA
Randy & Diana Castro- Owens, WA
Randy Behrendsen, WA
Randy J & Judy L Sprague, WA
Randy L & Lori L Olson, WA
Randy L & Robin J Johnson, WA
Randy L Chandler, WA
Randy L Eckstrom, WA
Randy Lee Sorensen, WA
Randy R & Debra J Fisler, WA
Randy Ruggles, OR
Randy Schleis, WA
Randy Wiser, WA
Raphael Donayri, OR
Raul M & Jennifer Rojas, WA
Ray Gilbertson, WA
Ray Hines, WA
Ray K. Chapman, Jr., WA
Rayella Oppenlander, OR
Raymend L & Misty R Dupuis, WA
Raymond & Mary Hsu, WA
RAYMOND C & JANET M Christianson, WA
Raymond D Wilson, WA
Raymond E & Kassie M Clark, WA
Raymond E & Theresa J Bentley, WA
Raymond E Tibeau, WA
Raymond L & Beverly J Johnson, WA
Raymond O & Gayle A Goin, WA
Raymond R & Beverly A Carr, WA
Raymond T & Gail Arrington, WA
Rayner Ward, OR
Rebeca Reese, OR
Rebecca D. Gray, WA
Rebecca F Hughes, WA
Rebecca I Panzer, WA
Rebecca Pearson, WA
Rebekah M Mergenthal, WA
Rem & Joy Heng, WA
Rene Berblinger, OR
Renee Smith, WA
Reuben & Heather Hokanson, WA
Rex O & Joanne Bratton, WA
Rhonda Bekker, WA
Rhonda Peterson, WA
Ricardo A & Valerie Gallagher, WA
Richard & Angela Stanley, WA
Richard & Arlene Nation, WA
Richard & Cindy Fuhr, CO
Richard & Claralee Williams, WA
Richard & Crissy Leigh Dills, WA
Richard & Delores Irvine, WA
Richard & Donna Eliason; & Donald & Helen Eliason, WA
Richard & Judy Inch, WA
Richard & Kassel Rana Thomasy, WA
Richard & Kristi Fawver, WA
Richard & Lana I Zielinski, WA
Richard & Melinda Mark, WA
Richard & Rae Hahn, WA
Richard & Susan Muxen, WA
Richard A & Andrea Porter, MD
Richard A & Melinda A Endres, WA
Richard A Rizzs, WA
Richard B & Victoria Olsen, WA

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Richard Bryant, WA
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Richard C Winter, WA
Richard Colombo, OR
Richard D & Kristina M Jenkins, WA
Richard D & Phyllis J Krueger, WA
Richard D Born, WA
Richard Delamare, WA
Richard E & Linda G Powell, WA
Richard F Glad, WA
Richard G & Sarah J Sando, WA
Richard H & Dana L Edmondson, WA
Richard Hanschu, OR
Richard Houghton, WA
Richard J & Behrend, Joy R Woods, WA
Richard J & Joan E Dwyer, WA
Richard J & Pok Sun Arnold, WA
Richard J Leon, WA
Richard J., Jr Kleemeyer, WA
Richard Jr & Karen D O'Neil, WA
Richard Keenan, WA
Richard L & Helen R Orcutt, WA
Richard L & Susan M Hall, WA
Richard L., Sr & Mary A Yaple, WA
Richard M. Schurman (Trust), CA
Richard M., III Westover, WA
Richard Magathan, OR
Richard Nakada, WA
Richard P & Tam L Nguyen, WA
Richard P., II & Gretchen A. Austin, WA
Richard R Carroll, WA
Richard Schmitz, OR
Richard Schultz, WA
Richard T & Tonya R Watanabe, WA
Richard W & Catherin Flanders, WA
Richard W & Tina M Bredengerd, WA
Richard W Drosman, OR
Richard W. & Elizabeth R. Rathbun, WA
Richard Winfield & Julie Hart, WA
Richards Trust, WA
Rick Martin, WA
Rick N Young, WA
Rick R Moser, WA
Ricky & Rosalinda V Eser-Jose, WA
Ricky Joseph, Real Property Officer, WA
Ricky L & Debra L Benner, WA
Rigoberto & Maria Salinas, WA
Riley M & Coleen Barlow, WA
Robert & Cain, Candace Samuels, CA
Robert & Davis Peggy Fleet, WA
Robert & Helen Sullivan, OR
Robert & Jessica Hester, WA
Robert & Kathleen Clawson Collins, WA
Robert & Kathleen Schroeder McNeill, WA
Robert & Kerstin Adams, OR
Robert & Linda Larrabee, WA
Robert & Lucinda King, WA
Robert & Steve Schuler, WA
Robert A & Cynthia Cox, WA
Robert A & Tara B Sorensen, WA
Robert A Silva, WA
Robert A Wick, WA
Robert A. Pastorok, WA
Robert B & Carrol J Grady, WA
Robert B & Jacquelin Stewart, WA
Robert B & Shawn M Miller, WA
Robert B Calkins, WA
Robert Boyd, WA
Robert Brady, WA
Robert C & Aprel D Stegman, WA
Robert C. Bruner, WA
Robert C. Mitchell, WA
Robert Cecil Cooke, OR
Robert Craig Cornwell, WA
Robert Crane, OR
Robert Crepps, WA
Robert D & Florence Wigre, WA
Robert D & Lynn D & David Zeigler, WA
Robert D & Lynn Knight, WA
Robert D & Marlene L Anunson, WA
Robert D & Melinda R Arco, WA
Robert D Mahaffey, WA
Robert Dean Larsen, WA
Robert E & Brenda L Smith, WA
Robert E & Janice Fleishman, WA
Robert E & Michelle M Welling, WA
Robert E & Sheri L Critchfield, WA
Robert E Burton, WA
Robert E Schellhase, WA
Robert Eterno, OR
Robert F Petty, WA
Robert Fogt, WA
Robert H Quick, WA
Robert Holland, OR

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Robert J & Delores M Gries, WA
Robert J & Kimberly A McKeough, WA
Robert J & Mary E Skillman, WA
Robert J Black, WA
Robert Jarvis, OR
Robert K & Karen V Perrine, WA
Robert K & Mary E Stone, WA
Robert Kopka, DC
Robert Kristopher Pelan, WA
Robert L & Suzanne C Holmes, WA
Robert L Rooney, WA
Robert L. Ensley, WA
Robert Lee Harding, WA
Robert Lorey, KS
Robert Lowrance, OR
Robert M & Marie A Day, WA
Robert M Hathaway, WA
Robert M Koivisto, WA
Robert M Schoenfeld, WA
Robert M. Decker, OR
Robert Mackimmie, OR
Robert Meyer, WA
Robert P Johnston, WA
Robert Pallett, OR
Robert R & Louise D James, WA
Robert S & Debra L Cason, WA
Robert S & Joanne Anderson, WA
Robert S & Lisa R Williams, WA
Robert S & Shawna K Bain, WA
Robert Stang, OR
Robert Tindall, OR
Robert VanElverdinghe, OR
Robert W & Deborah G Parsons, WA
Robert W & Karen J Backstrom, WA
Robert W & Susan H Checca, WA
Robert W Foss, WA
Robert W Pederson, WA
Robert W Postma, WA
Robert Walling, WA
Robert Winsor, WA
Roberta Brice, OR
Robin Johnson, OR
Robin R Pfander, WA
Robin Stanley, WA
Roble Anderson, OR
Robynn Rodriguez, OR
Rod E Fenstermaker, WA
Rod Nelson, WA
Roderick F & Miriam R Faubion, WA
Roderick M & Joanne J Toll, WA
Roderick Morris, OK
Rodney & Patricia A Pfeifle, WA
Rodney A & Jaime J Maxie, WA
Rodney J Wort, WA
Rodney L. C. Nelson & Laurine D. Newberg, WA
Rodney R Peterson, WA
Rodney T & Heidi J Lakey, WA
Rodney William Lefeber, WA
Rodney Z James, OR
Rodolfo Umali, WA
Roger & Darcie Hays, OR
Roger A & Debra L Parry, WA
Roger A & Merry E Pettijohn, WA
Roger C & Jan A Reed, WA
Roger G Maki, WA
Roger H Molvar, WA
Roger J Widenoja, OR
Roger K. & Catherine A. Hoesterey, WA
Roger L & Karen E Crewse, WA
Roger Lindsley, OR
Roger R & Teresa E Robert, WA
Roger Rocka, OR
Rolf G & Christine M Kruger, WA
Romit & Carolina Singh, WA
Ron L & Clark Jenni L Clark, WA
Ron W. MacKenzie, OR
Ronald & Molly Giovanetti, WA
Ronald & Toni Farnsworth, WA
Ronald Clark, WA
Ronald Corder, WA
Ronald D & Pamela M Newman, WA
Ronald D & Pauline Oberlander, WA
Ronald D., Jr & Tiffany T. Harmon, WA
Ronald H Shanander, WA
Ronald J & Barbara G Campbell, WA
Ronald K Fox, WA
Ronald L Newenhof, WA
Ronald M & Beverly F Nelson, WA
Ronald M & Caroline J Nichols, WA
Ronald M & Meehan Ann Rene Rudge, WA
Ronald Marasco, WA
Ronald Oathes, Jr., WA
Ronald S Walt, WA
Ronald Schiffman, OR
Ronald Throupe, WA
Ronald Tokarz, WA

Individuals (cont'd)

Ronald W. Tritten, WA
Ronghua & Ho Geok Chin Jin, WA
Rose Lee, WA
Rose M Zinicola, NY
Ross Bondurant, OR
Ross W & Marjorie A Silver, WA
Rostislav & Nataliya Nagulyak, WA
Roxanne Crocker, WA
Roy C. Jordan, OR
Roy E & Margaret A Newman, WA
Roy H & Lisa F Delavergne, WA
Roy Hitz, OR
Roy W & Sheryl M Hill, WA
Roy Wahle, OR
Royce D & Sonia L Williams, WA
Russ Garnett, OR
Russell A & Deanna L Berglund, WA
Russell A Silva, WA
Russell Ashdown-Kroese, OR
Russell Boehm, WA
Russell C & Lisa G Jensema, WA
Russell Hall, OR
Ruth Bolliger, OR
Ruth Heft, WA
Ruth R Allen, WA
Ryan & Berryessa, Ashley Abel, WA
Ryan & Jessica Breeden, WA
Ryan & Spencer, Jessica Williams, WA
Ryan A & Heather N McBee, WA
Ryan A Dell, WA
Ryan Berryhill, WA
Ryan Castro, WA
Ryan D Moore, WA
Ryan Hyke, WA
Ryan J Dennis, WA
Ryan M & Diane L Dunne, WA
Ryan M Grose, WA
Ryan M Hallock, WA
Ryan T Mickey, WA
Ryan VanCleave, WA
S T Humphries & Helen Reynolds, WA
Sammie Connors, WA
Samok & Vandy Ouch, WA
Samuel A & Sue A Huff, WA
Samuel L & Jessica L Houston, WA
Samuel R Christie, WA
Samuel W., Chick & Michelle M. Henderling, WA
Sandra Cardenas, WA
Sandra Ferland, WA
Sandra K & Michael T Hagadone, WA
Sandra K & Riche, Ronald A Rice, WA
Sandra L. From & Kevin M. Mejia, WA
Sandra Leonard, WA
Sandra M Seedorf, WA
Sandra Mitchell, WA
Sandra Ruzicka, WA
Sandra S Sircin, WA
Sandy Murray, OR
Sara A & Torey G Donovan, WA
Sara E Griffin, WA
Sara S. Uzzell-Rindlaub & John V. Rindlaub, WA
Sarah A Lynch, WA
Sarah J Hintz, WA
Sarah Leyrer, WA
Savin Nou, WA
Sawvalok Kissner, WA
Scot D & Deborah K Thomson, WA
Scott & Daralee Newkirk, WA
Scott & Holly Smolinsky, WA
Scott & Jody Wickett, WA
Scott & Mara Jean McDonald, WA
Scott & Megan Andrews, WA
Scott & Nancy Moeller, WA
Scott & Purdin, Perry Casey, WA
Scott & Sylvia Robinson, WA
Scott A & Carlene A Duda, WA
Scott A & Michele R Darrington, WA
Scott Ater, WA
Scott B Murray, WA
Scott D & Traci Sciuchetti, WA
Scott D Ringwood, WA
Scott G. Walker, WA
Scott H White, WA
Scott J & Cheryl E Shipman, WA
Scott J & Corrin A Molvar, WA
Scott J. Rozenbaum, WA
Scott O & Kaycee Stackle, WA
Scott R & Heidi D Bee, WA
Scott R & Lora R Butterfield, WA
Sean & Brittanie Pruden, WA
Sean & Preboski, Emily Michel, WA
Sean & Rebecca McCullough, WA
Sean M & Ellen R Lindstrom, WA
Sean N Moore, WA
Sean P Nispel, WA
Seokkyun & Jordan Hong, WA
Seongho & Jiyoon Kim Wee, WA

Individuals (cont'd)

Sergey & Ludmila Garkusha, WA
Sergio & Amy Castaneda, WA
Sergio B Gonzalez, WA
Sha Spady, OR
Shadia & Elbou Ouldtaki Kaiefa, WA
Shane K & Susan M Tapert, WA
Shane M & Kimberly J Kelly, WA
Shane R & Alexis Tackett, WA
Shane R & Melissa R Larango, WA
Shannon & Christine Bruil, WA
Shannon Buck, OR
Shantanu Subhash & Anagha Deo, WA
Shari L Fry, WA
Shari Lee Phillips, WA
Sharon E Hendrickson, WA
Sharon E. Robbins & James R. Danforth, WA
Sharon L Johnston, CA
Sharon Schrock, OR
Sharon Verschuyl, WA
Shaun & Chastity Van Auken, WA
Shaun D & Christina Stauffer, WA
Shawn & Rachel Smith, WA
Shawn Hosford, WA
Shawn N. C. & Yolanda R. Drennen, WA
Shawna L Gonzales, WA
Sheila Conner, WA
Sheila Lang, WA
Sheila Warren, OR
Shel Cantor, OR
Sheldon J & Karen M Bukantz, WA
Shelia Starrett, WA
Shelley Burns, WA
Shelley S Weber, WA
Sheri Staley, WA
Sherif H Mahmoud, WA
Sherri BOWE, WA
Sherry L & Larry R Summers, WA
Sherry L. Vick-McLean & Shawn P. McLean, WA
Sherry Willoughby, OR
Sheryl J Lindquist, WA
Shin & Yumika Kodaira, WA
Shirlee Nash, OR
Shirlee Wallot, WA
Shu-Fang Huang, WA
Sidney B & Amelia J Stark, WA
Sigrid Asmus, WA
Simon Ross, WA
Sixto & Rosario Zaragoza, WA
Sol Riou, WA
Stacey L Jaimes, WA
Stacey L. Mort, WA
Stacey Lynne Smythe, WA
Stacie K. Joyce & Gerald K. Young, WA
Stan P & Jeff A Olson, UT
Stanley & Angela Wayment, WA
Stanley & Teresa Schmidt, WA
Stanley A & Connie K French, WA
Stanley C Warzecha, WA
Stanley G Ford, WA
Stanley Startzman, WA
Stanley Taylor, OR
Stedham Family Living Rev Trust, Ann Stedham, WA
Steen McFadden, MT
Stefan E Fafnis, WA
Stephanie D & Hoover N Wilson, WA
Stephanie Gay, WA
Stephanie Horrocks, WA
Stephanie L Call, WA
Stephanie M Long, WA
Stephanie Swift & Jamie Glenisky, WA
Stephanie Velie & Constance Gee, WA
Stephen & Brian Davidson, WA
Stephen & Connie Cross, WA
Stephen & Maria Dennehy, WA
Stephen & Roseanna D Cherrington, WA
Stephen & Sharon Marks, WA
Stephen Anderson, WA
Stephen Caldwell, OR
Stephen D Cottrell, WA
Stephen H Buroker, WA
Stephen Ho-Yuen Mak, WA
Stephen J Bartlett, WA
Stephen J Caputo, WA
Stephen J Pogue, WA
Stephen L & Janet E Holmer, WA
Stephen L & Poitina Fraser, WA
Stephen L & Serena A Swanson, WA
Stephen M & Heather A Rowan, WA
Stephen M & Sarah Biggerstaff, WA
Stephen Steinhoff, IA
Stephen W & Breezy M Hadeen, WA
Steve & Christofferson Marsha Christofferson, WA
Steve & Edlyn Warner, WA
Steve Dragich, WA
Steve Felkins, OR
Steve G & Deborah E Ellingson, WA
Steve L Eggers, WA

Individuals (cont'd)

Steve W Blankenship, WA
Steve Wilson, OR
Steven & Amy Ensminger, WA
Steven & Barbara Andersen, WA
Steven & Georgina Hamm, WA
Steven & Jolita Truett, WA
Steven & Kay Johnson, WA
Steven & Susan Persing McLain, WA
Steven & Yvonne Honea, WA
Steven A & Deborah N Ouimet, WA
Steven B Kenney, WA
Steven C & Tina M Benekas, WA
Steven C Hill, WA
Steven Coleman, OR
Steven D. & Harriet Koscho, WA
Steven E & Karen M Johnson, WA
Steven E Martin, WA
Steven G & Carmen L Grace, WA
Steven G & Larae Norbjerg Hopkins, WA
Steven J & Kathleen M Cummins, WA
Steven J & Lori R Gordon, WA
Steven Jacobson, WA
Steven Jun Kim, WA
Steven L Fitterer, OR
Steven Mueller, OR
Steven P & Marta Masters, WA
Steven R & Rhonda K Ward, WA
Steven R Karpman, WA
Steven Shane & Cynthia Bidwell, WA
Steven T & Julie D Gutzler, WA
Steven W & Angela A Watkins, WA
Stowell & Casey, Shannon Holcomb, WA
Stuart Poston, WA
Sue A Tenkley Trust, Gary, WA
Sue Noble, OR
Sue Skinner, OR
Sumanta K & Sanghamitra M Pal, WA
Sunny R Stiles, WA
Supratim & Chowdhury, Bonnhi De, WA
Supriya & Kunal, Gaind Kumari, WA
Susan A Betts-Donnelly, WA
Susan Arbor, OR
Susan Burke-Crum & Marvin, Jr Crum, WA
Susan C Sheythe, OR
Susan Chapman, OR
Susan Cobb, OR
Susan D George, WA
Susan E Markley, OR
Susan F Shemeta, WA
Susan Fahsel, WA
Susan Hess, OR
Susan J Gray, WA
Susan KhalsaWyborski, OR
Susan Martin, OR
Susan Mikkelsen, WA
Susan Padgett, OR
Susan Parrish, WA
Susan Rea Thramer, WA
Susan Rosen, Wa
Susan S Neidig, WA
Susan Zeman, WA
Susana Gladwin, OR
Susannah B & Jason D Barr, WA
Susanne Wilson, WA
Susheel L & Swaran L David, WA
Suzan L. Waddington & Charles W. Burr, WA
Suzanne Bahl, OR
Sylvia Black, OR
Sylvia J Hjelmeland, WA
Sylvia M Madsen, WA
Sylvia Zingeser, OR
Sz-Tsung Sun, WA
T Wasson, WA
T. K. Stewart & David K. Black, WA
T. L. Cannon, WA
Tahj & Emily Bomar, WA
TAK Memorial Trust, WA
Tamara Wehrer, WA
Tammy Chagolla & Matthew R. Noffke, WA
Tammy R Tiede, WA
Tanafriti Wright, WA
Tanja Wilcox, WA
Tara & Michael Rudolph, WA
Tatyana A Kimball, WA
Ted Chism, OR
Ted Thomas, OR
Tenzin & Amney, Kensang Dhongthog, WA
Tera Frydenlund, WA
Tera McCranie & Todd Green, WA
Teresa & McDonald, Heath Larson, WA
Teresa DeLorenzo, OR
Teresa H. Ralston, WA
Teresa L Roach, WA
Terie Remington, OR
Terrance & Kami Johnson, WA
Terry & Ingrid Powell, WA
Terry & Janet Steiner, WA

Individuals (cont'd)

Terry & Phyllis Posey, WA
Terry D & Raeann L Laberge, WA
Terry Hill, WA
Terry Hughes, WA
Terry HymanWalsh, WA
Terry L & Vicki L Machovsky, WA
Terry L McFarling, WA
Terry L. & Sandra Day Aho, WA
Terry Marshall, WA
Terry N & Sally M Thompson, WA
Terry S & Donna L Deahl, WA
Terry W & Edythe R Cottrell, WA
Terry W & Julie L Lee, WA
Thad Taylor, WA
Thea Mae Enright, OR
Thelma & Gene Neathamer, WA
Thelma Butzlaff, OR
Theodore Gibson, WA
Theodore Vandermey, WA
Theresa P. Webster, WA
Thomas & Ann Beaulieu, WA
Thomas & Kimmie Wilson, WA
Thomas & Lori Klobucar, WA
Thomas & Tess Alverson- Hollern, WA
Thomas (Trustee) Lindberg, OR
Thomas A & Diana M Loback, WA
Thomas A & Jamie L Floch, WA
Thomas C & Janice E Morris, WA
Thomas Detman, CO
Thomas E & Catherine A Mooney, WA
Thomas E & Teresa E Stone, WA
Thomas Gritzka, OR
Thomas H & Janice A Reid, WA
Thomas H Nelson, WA
Thomas Hardy & Marie A. Tailor, WA
Thomas J & Catherine W Rogers, WA
Thomas J Matson, WA
Thomas J Morraitis, WA
Thomas J. Abbe & Jolynne Leitzel, WA
Thomas Johnston, OR
Thomas L & Susanne S Harvey, WA
Thomas M & Heidi M Batten, WA
Thomas M & Rocchetta C Witte, WA
Thomas M DeSpain, OR
Thomas Mathews, OR
Thomas Morrison, OR
Thomas P & Glenna A Maskal, WA
Thomas P & Mary T Mathew, WA
Thomas P & Susan S Nieswander, WA
Thomas R & Julie A Hargan, WA
Thomas S Rogers, WA
Thomas V & Devi D Griswold, WA
Thomas V & Jane M Rowland, WA
Thomas W & Paula A Shoemaker, WA
Thomas W Grossi, WA
Thome Family Living Trust, Ted, WA
Thomson Trust, John D. & Joanne L. Thomson, Trustees, WA
Tiffany A & Marshal Spardo, WA
Tiffany Greer, WA
Tiffany Hedrick, WA
Tiffany P. Mendoza & Adam R. Trantina, WA
Tiffany S. Daly & Ronald F. Watts, WA
Tim & Bobbie Smith, WA
Tim & Diane Dorsey, WA
Tim & Susan Howard Ebling, WA
Tim Bero, OR
Tim C Barnes, OR
Tim J & Cathy L Harris, WA
Tim Thuston, TX
Timothy & Mary Ann Lindberg, WA
Timothy & Sharlene L Harbison, WA
Timothy & Susan Heath, WA
Timothy & Teresa Jenine Schlager Collins, WA
Timothy A Boullion, WA
Timothy Bradshaw, WA
Timothy D Kropf, WA
Timothy Gansneder, WA
Timothy J & Danette R StClair, WA
Timothy K & Julie A Johnson, WA
Timothy K Boyd, WA
Timothy P & Mary E Gray, WA
Timothy Paulsen & Michelle Pease-Paulsen, WA
Timothy Stanhope, WA
Timothy Szambelan, WA
Tina L Dixon & R Paul Stredwick, WA
Tina L Tricoli, WA
Tina Zimmer, WA
Toby S Peterson, WA
Todd & Michelle Maki, WA
Todd & Patricia Stuth, WA
Todd A & Lisa Peters, WA
Todd A & Lori J Dail, WA
Todd L & Tracy M Oman, WA
Todd W. & Carol A. Snyder, WA
Toji T & Eapen Anu Oommen, WA
Tom & Lorene Ehlers, WA
Tom Bender, OR

Individuals (cont'd)

Tom Carr, OR
Tom Finch, CO
Tom Myers, OR
Tom Sawtell, OR
Toni R Burton, WA
Tony & Megan Navilio, WA
Tony Bennett, WA
Tony J Phillips, WA
Top Family Trust, WA
Topelagi Siva, WA
Torben & Marilyn Ferslov-Jensen, WA
Tracey Chapman, OR
Tracie A Jarratt, WA
Tracy Burns, WA
Tracy Davis, WA
Tracy S Jilek, WA
Travis Hayes, WA
Travis K M Winslow, WA
Travis R. & Tabatha T. Taylor Olson, WA
Travis Sessler, WA
Trent D & Vicki L Taylor, WA
Trent R Smith, Jensen G. R. 1977 Living Trust, WA
Trevor W Walstad, WA
Troy L Church, WA
Trula J Thompson, WA
Ty & Rachel Kimball, WA
Tybalkt J Quale, WA
Tyler & Jacklyn Whitehouse, WA
Tyler E Ford, WA
Tyler R & Stephanie M Berry, WA
Tyron Lee, OR
Ubaldo Sanchez, OR
Uma Subramanian & Srinath Kannan, WA
V Paul & Carol H Buehler, WA
Vadim & Yana Bednaruk, WA
Valerie & Morris Hernandez, WA
Valerie Hauer, WA
Vamsi & Kurup Preeti Kuppa, MN
Vance Chad Pinson, WA
Vancell Shaw, WA
Vanessa Lee, WA
Vanita J Miller, OR
Varonica Koon, OR
Venetia A Runnion, WA
Veniamin & Alla Bidniy, WA
Vern W Forsberg, WA
Verne & Margaret Qualls, WA
Vernon H Crim, WA
Vernon Suggett, WA
Vernon W. Chandler & Jennifer M. Gilmon, WA
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Victor G & Judith E Adams, WA
Victor Phan Tran, WA
Victoria A Schmidt, WA
Victoria Dell, WA
Victoria J & John T Thrush, WA
Victoria Lowe, OR
Victoria Meier, OR
Vincent J & Angela Geglia, II, WA
Vincent Mustacich, WA
Vincent O & Dell M Reyes, WA
Viorel & Nicoleta Chita, WA
Virgie & Jimmy Bernabe, WA
Virgil & Leona M Baker, WA
Virgil C & Marlys M Harberts, WA
Virginia Allison, WA
Virginia D Merchant, WA
Virginia Gibbs, OR
Virginia Good & Thomas E. Vlahovich, WA
Vitaliy & Oksana Stryzheus, WA
Vladimir & Gurtovaya Razinkov, WA
W & C Rogers, WA
W T & Sheryl Jean Rogers, WA
W.A. & A.M. McNamara & Moskowitz-McNamara, WA
Waid G Easton, WA
Waite Living Trust, WA
Wallace D & Darlene K Keen, WA
Wallace N Soland, WA
Wallace W Weber, WA
Wallace W. Mattila, WA
Walter Aman, OR
Walter B., III Schroeder, OR
Walter D Austin, WA
Walter D Millo, WA
Walter H Johnson, WA
Walter L Blinde, OR
Walter M Thayer, WA
Walter R & Janet A Ivanoff, OR
Walter W & Rosetta J Kellogg, WA
Wanda Collins, WA
Warren & Juanita Beecroft, WA
Warren D Aikins, OR
Warren John West, OR
Warren Taylor, WA
Wayne & Sandra Wright, WA
Wayne & Sharon Rengen, WA
Wayne A & Cherie R Toso, WA

Individuals (cont'd)

Wayne E & DeGregory, Carol A Scardigli, WA
Wayne E & Lynn M Larson, WA
Wayne Jorgensen, WA
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Wayne, Jr Radford, WA
Wendal H Kuecker, WA
Wendell H. Lovett, WA
Wen-Ying & Hao Hung, WA
Wesley & Christine Pellum, AZ
Wesley A Christianson, OR
Wesley P & Jackie K Haynes, WA
Wilford E Stipp, WA
Wilfred A Sundstrom, WA
William & Althea G Heagy, WA
William & Bella Cooper, WA
William & Cheryl Chapman, WA
William & Jodi Halfhill, WA
William & Kathleen Thias, WA
William & Kellie Araki, WA
William & Mayer, Sarah Zetterwall, WA
William & Melissa Nelson, WA
William & Sheilla C Hagedorn, WA
William & Trina Watters, WA
William & Victoria Zimmerman, WA
William A & Christine E Price, WA
William A Tover, WA
William A. Theiss, OR
William B. & Jody K. Sorenson, WA
William Berry Sr & Delina Ann Malcoh, WA
William Birka, WA
William Brown, OR
William C & Priscilla Grover, TX
William C Elliott, WA
William C Jr & Carolyn J Game, WA
William C JR Elliott, WA
William Conner, WA
William D & Janice L Thackeray, WA
William D & Lynn B Keys, WA
William Dickas, OR
William E & Jeanene M Speck, WA
William E & Marilyn M Walner, WA
William E & Mary C Favier, WA
William E. & Paulette S. Hartman, WA
William Earl & Barbara A Mitchell, WA
William Evans, WA
William G & Kathleen Hankins, WA
William G Whiteaker, WA
William Gefroc, OR
William H & Mary E Lord, WA
William H., Jr & Roberta Ingram, WA
William Harrison Monroe, WA
William Hart, OR
William Hundley, OR
William J & Lisa K Brill, WA
William J & Phyllis Campbell, WA
William J & Suzanne F Mortell, WA
William J & Tonya Pearson, WA
William J Ingerson, WA
William J Spagnola, WA
William L & Joann Wooda Heinz, WA
William L Baskett, WA
William M & Denise A Lettig, WA
William M & Peggy K Keough, WA
William Marshall, OR
William N & Silvia E Tester, WA
William N. & Patty L. Kaaland, WA
William N. & Patty L. Kaaland; & Jerry L. & J Lorna Allan, WA
William P & Kathleen S Brown, WA
William R & Rebecca S Wilder, WA
William R & Susan I Fox, WA
William R Banks, WA
William R ETAL Billups, WA
William Russell, NV
William S & Yon O Atkins, WA
William Schwall, OR
William Stricklin, CA
William Sunquist, WA
William Van Dyke, OR
William W & Angela L Peak, WA
William Weinhart, WA
Wilma Jean Bowen, WA
Winfred Coleman, WA
Wu-Shyung Lee, WA
Yadong Wang, WA
Yale Smith, WA
Yandle Moss, WA
Yeng & Chong Cha, WA
Ynnette M Collins, WA
Yolanda Williamson & Paul W. Murray, WA
Yolande Witter, WA
Yu-Chin Jou, WA
Yuriy & Yuliya Mikhalchuk, WA
Yvette M Nichols, WA
Yvonne R DeMiranda, OR
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Zhorzh & Zhanna Godzyuk, WA

Individuals (cont'd)

Zhu Zhuo, OR

Zsuzsa Mayer, WA

APPENDIX B

CONSULTATION AND MEETINGS

Appendix B1: Coast Guard Documents

Appendix B2: Meetings Hosted by Oregon LNG and Northwest

Appendix B3: Summary of Tribal Consultations

APPENDIX B1

COAST GUARD DOCUMENTS

Oregon LNG

8100 NE Parkway Drive, Suite 165
Vancouver, WA 98662
(503) 298-4969

May 23, 2007

Captain Patrick Gerrity
Commanding Officer
United States Coast Guard
Sector Portland
6767 North Basin Avenue
Portland, OR 97217

Dear Captain Gerrity,

As required by 33 Code of Federal Regulations 127.007, LNG Development Company, LLC dba. Oregon LNG hereby submits a Letter of Intent (LOI) to build a new Waterfront Facility Handling Liquefied Natural Gas on the Skipanon Peninsula in Warrenton, OR. The proposed site is within the jurisdiction of the Captain of the Port, Sector Portland Oregon. The Preliminary Waterway Suitability Assessment (PWSA), developed in accordance with the requirements of "Navigation and Vessel Inspection Circular No. 05-05 – Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic" ("NVIC 05-05"), is submitted as an enclosure to this Letter of Intent.

Paragraph (d) of 33 CFR 127.007 requires each Letter of Intent to contain —
(1) The name, address, and telephone number of the owner and operator;
(2) The name, address, and telephone number of the facility;
(3) The physical location of the facility;
(4) A description of the facility;
(5) The LHG or LNG vessels' characteristics and the frequency of LHG or LNG shipments to or from the facility; and
(6) Charts showing waterway channels and identifying commercial, industrial, environmentally sensitive, and residential areas in and adjacent to the waterway used by the LHG or LNG vessels en route to the facility, within 25 kilometers (15.5 miles) of the facility.

Oregon LNG, which is headquartered at 8100 NE Parkway Drive, Suite 165, Vancouver, WA 98662, plans to develop, construct, and operate a liquefied natural gas ("LNG") receiving, storage, and regasification facility on the East Skipanon Peninsula (ESP), near the confluence of the Skipanon and the Columbia Rivers in Warrenton, Clatsop County, Oregon ("LNG Terminal"). Oregon LNG CEO is Mr. Peter Hansen (360-859-1100).

The proposed LNG Terminal would be located on the northern portion of the East Skipanon Peninsula at River Mile 11.5 (statute miles) of the Columbia River, within an approximately 96-acre parcel of land that is owned by the State of Oregon and leased to the Port of Astoria by the Oregon Department of State Lands. The 96-acre parcel of land is subleased to LNG Development Company, LLC by the Port of Astoria.

The LNG Terminal will include a pier with one LNG berth, LNG unloading equipment, an LNG storage facility consisting of three full-containment above ground 160,000 m^3 LNG storage tanks, vaporization and vapor handling systems, a sendout system, and administrative, control and support buildings. The tanks will each have a primary inner container and a secondary outer container, and will be designed so that both the self-supporting inner container and the secondary container can independently contain the entire amount of the LNG product. The inner container will be made of 9% nickel alloy steel, and the outer container will be pre-stressed reinforced concrete. The annular space between the sidewalls of the inner and outer tanks will be insulated with a loose fill expanded perlite and a fiberglass blanket.

The LNG Terminal will be connected to the existing interstate pipeline system via a new interstate natural gas pipeline extending from the LNG Terminal. The terminal will be designed to berth and unload LNG tankers of up to 260,000 cubic meters (m^3). Approximately two to three ships per week will call on the Terminal.

The proposed transit route for LNG vessels arriving at the proposed Terminal extends 21.5 miles from entry into U.S. Territorial Waters, twelve nautical miles offshore the coast of Oregon, through the mouth of the Columbia River, along the Desdemona Channel, and to the proposed Project Site at Skipanon, Warrenton, Oregon. Appendix A of the Preliminary Waterways Suitability Assessment (PWSA) (Enclosure #1) includes four (4) charts, which graphically portray the intended track line for LNG vessels to transit to the proposed LNG terminal on the Skipanon Peninsula, with the Sandia Zones of Concern applied the length of the intended transit. The charts also indicate high, medium and low population densities in the area of the proposed transit, critical infrastructure, and important structures such as schools, hospitals and large commercial buildings. Environmentally sensitive areas will be identified on these navigation charts as part of the Follow-on WSA.

I look forward to answering any questions that may develop as a result of your staff's review of this LOI and the accompanying Preliminary Waterway Suitability Assessment (PWSA). Once Oregon LNG has begun the Pre-Filing process with the Federal Energy Regulatory Commission (FERC), we will complete the Follow-on Waterways Suitability Assessment as required by NVIC 05-05.

Sincerely,

Peter Hansen, CEO
Oregon LNG

Enclosure 1: "Preliminary Waterways Suitability Assessment (PWSA) for the Proposed Skipanon LNG Receiving Terminal"

U.S. Department of Homeland Security
United States Coast Guard

Commander
United States Coast Guard
Sector Portland

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Portland, Oregon 97217-3992
Phone: (503) 240-9374
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e-mail: Russell.A.Berg@uscg.mil

16611/OREGON LNG
April 24, 2009

Mr. Peter Hansen
Oregon LNG
8100 NE Parkway Dr. Suite 165
Vancouver, WA 98662

Dear Mr. Hansen:

Enclosed you will find a copy of the Letter of Recommendation (LOR) issued pursuant to 33 C.F.R. § 127.009 in response to your Letter of Intent (LOI) dated May 23, 2007 proposing to transport Liquefied Natural Gas (LNG) by ship to a proposed receiving terminal at Warrenton, Oregon. It conveys the Coast Guard's determination on the suitability of the Columbia River for LNG marine traffic as it relates to safety and security. An LOR Analysis and Supplemental LOR Analysis accompany the LOR. Under NVIC 05-08, the LOR Analysis replaced the Waterway Suitability Report (WSR) detailed in the previous NVIC, 05-05. As a point of clarity, the LOR Analysis is the same as the WSR. In addition to meeting the requirements of 33 C.F.R. § 127.009, this letter also fulfills the Coast Guard's commitment for providing information to the Federal Energy Regulatory Commission (FERC) under the Interagency Agreement signed in February 2004.

Should you feel aggrieved by this decision, you may request reconsideration pursuant to 33 C.F.R. § 127.015(a). For your information, any request for reconsideration must be submitted to me in writing, within 30 days of receipt of this letter. You may also request reconsideration in person if the written request would have an adverse impact on your operation.

If you have any questions, my point of contact is Mr. Russ Berg. He can be reached the above address, phone number and e-mail.

Sincerely,

F. G. MYER
Captain, U. S. Coast Guard
Captain of the Port

Enclosures: (1) Letter of Recommendation
(2) Letter of Recommendation Analysis
(3) Supplemental Letter of Recommendation (SSI – not publicly releasable)

U.S. Department of Homeland Security
United States Coast Guard

Commander
United States Coast Guard
Sector Portland

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16611/OREGON LNG
April 24, 2009

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

LETTER OF RECOMMENDATION FOR OREGON LNG TERMINAL

Dear Ms. Bose:

This Letter of Recommendation (LOR) is issued pursuant to 33 C.F.R. § 127.009 in response to the Letter of Intent (LOI) submitted by Oregon LNG (Applicant) dated May 23, 2007 proposing to transport Liquefied Natural Gas (LNG) by ship to a proposed receiving terminal on the Skipanon Peninsula in Warrenton, Oregon. It conveys the Coast Guard's determination on the suitability of the Columbia River for LNG marine traffic as it relates to safety and security. In addition to meeting the requirements of 33 C.F.R. § 127.009, this letter also fulfills the Coast Guard's commitment for providing information to your agency under the Interagency Agreement signed in February 2004.

After reviewing the information in the Applicant's LOI and completing an evaluation of the waterway in consultation with a variety of local port stakeholders, I have determined that the applicable portions of the Columbia River and its approaches are not currently suitable, but could be made suitable for the type and frequency of LNG marine traffic associated with this project. My determination is based on a review of the information provided in accordance with 33 CFR 127.007(d)(3) through (d)(6) and in consideration of the items listed in 33 CFR 127.009(b) through (d)(6). The reasons leading to my determination are outlined below.

On April 24, 2009 I completed a review of the Applicant's Waterway Suitability Assessment (WSA) submitted in March 2008 by Halcrow, Inc. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 05-08. The review focused on navigation safety and maritime security risks posed by LNG marine traffic associated with the proposed Oregon LNG project and the measures needed to responsibly manage these risks. During the review, the Coast Guard consulted with a variety of stakeholders including an *ad hoc* validation committee and the Area Maritime Security Committee. Following this review a LOR Analysis and Supplemental LOR Analysis (marked Sensitive Security Information (SSI)) were issued. These Analysis' identify the requirements, conditions and risk mitigation measures to ensure the safe movement of these vessels.

The Applicant's WSA includes risk management strategies and associated measures that were developed for the safe navigation and security at each maritime security level, and that if properly implemented, sufficiently mitigate the identified risks associated with LNG vessel traffic for the proposed facility. These risk mitigation measures and strategies have been documented in the enclosed LOR Analysis and Supplemental LOR Analysis (SSI). Based on my review and the full implementation by the Applicant of the measures outlined in their WSA, the LOR Analysis and Supplemental LOR Analysis, I have determined that the Columbia River leading up to Oregon LNG could be suitable for the type and frequency of LNG marine traffic associated with this project.

While this letter has no enforcement status, the determinations, analysis, and ultimate recommendation as to the suitability of this waterway, as contained in this letter, would be referenced in concert with a Captain of the Port Order, should an LNG transit be attempted along this waterway without full implementation of the risk mitigation measures. Such an Order would be issued pursuant to my authority under the Ports and Waterways Safety Act of 1972, as amended by the Port and Tanker Safety Act of 1978, 33 U.S.C. § 1223, *et seq.*, among other authorities.

A copy of the LOR has been forwarded to the Applicant. Should the Applicant feel aggrieved by this decision, they may request reconsideration by me pursuant to 33 C.F.R. § 127.015(a). For your information, any request for reconsideration must be submitted in writing within 30 days of receipt of this letter. The Applicant may also request reconsideration in person if the written request would have an adverse impact on their operation.

If you have any questions, my point of contact is Mr. Russ Berg. He can be reached at the above address, phone number and e-mail.

Sincerely,

F. G. MYER
Captain, U. S. Coast Guard
Captain of the Port

Enclosures: (1) LOR Analysis
(2) Supplemental LOR Analysis (SSI – not publicly releasable)

Copy: Oregon LNG
Commandant, U. S. Coast Guard (CG-522, CG-541, CG-544)
Commander, Thirteenth Coast Guard District (dl, dp)
Commander, Coast Guard Pacific Area (Pp)
Coast Guard Maintenance and Logistics Command Pacific (sm)
Oregon Department of Energy
Oregon Department of Fish and Wildlife w/o SSI enclosure
Clatsop County Sheriff w/o SSI enclosure
Astoria Fire Department
Astoria Police Department
Warrenton Fire Department
Warrenton Police Department

U.S. Department of Homeland Security
United States Coast Guard

Commanding Officer
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16611/Oregon LNG
April 24, 2009

Ms. Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

LETTER OF RECOMMENDATION (LOR) ANALYSIS FOR OREGON LNG

Dear Ms. Bose:

On April 24, 2009, the Coast Guard completed a review of the Waterway Suitability Assessment (WSA) for the proposed Oregon LNG receiving terminal submitted by Halcrow, Inc. on behalf of Oregon LNG in March of 2008. This review was conducted following the guidance provided in Navigation and Vessel Inspection Circular (NVIC) 05-08 of Dec 22, 2008. The review focused on the navigation safety and maritime security risks posed by LNG marine traffic, and the measures needed to responsibly manage these risks. During the review, the Coast Guard consulted a variety of stakeholders including state and local emergency responders, Marine Pilots, towing industry representatives, members of the Harbor Safety Committee, and the Area Maritime Security Committee.

Based upon this review, I have determined that the Columbia River and its approaches are not currently suitable, but could be made suitable for the type and frequency of LNG marine traffic associated with this project. Additional measures are necessary to responsibly manage the maritime safety and security risks. The proposed risk mitigation measures are found in section 5 and section 7 of the submitted WSA. This LOR analysis clarifies as necessary, and in some cases expands the recommendations needed to responsibly manage the navigation, safety and security risks. The specific measures, and the resources needed to implement them where applicable, are described below and in a separate supplementary analysis which is being provided to you under the terms and conditions established for handling Sensitive Security Information. The supplemental analysis also includes a copy of the Oregon LNG WSA.

The following is a list of specific risk mitigation measures that are recommended to responsibly manage the safety and security risks of this project. Details of each measure, including adequate support infrastructure, will need further development through the creation of an Emergency Response Plan as well as a Transit Management Plan that clearly spell out the roles, responsibilities, and specific procedures for the LNG vessel and all agencies responsible for security and safety during the operation.

Navigational Measures:

- Safety/Security Zone: A moving safety/security zone will be established around the LNG vessel extending 500-yards around the vessel but ending at the shoreline. No vessel may enter the safety/security zone without first obtaining permission from the Coast Guard Captain of the Port (COTP). The expectation is that the COTP's Representative will work with the Pilots and patrol assets to control traffic, and will allow vessels to transit the Safety/Security zone based on a case-by-case assessment conducted on scene. Escort resources will be used to contact and control vessel movements such that the LNG Carrier is protected.

While the vessel is moored at the facility there will be a 200 yard-security zone around the vessel. In addition, there will be a 50 yard security zone around the LNG Terminal when there is not a vessel at the dock.

Resource Gap: Resources required to enforce the safety/security zone are discussed under Security Measures in the supplemental analysis.

- Vessel Traffic Management Due to a narrow shipping channel and navigational hazards, it is recommended that LNG vessels meet the following additional traffic management measures:
  - A Transit Management Plan be developed in coordination with River Pilots, Bar Pilots, Escort Tug Operators, Security Assets and the Coast Guard prior to the first transit.
  - Due to the sudden weather changes on the Oregon coast and the relatively exposed location of the proposed terminal, a weather matrix must be a part of the recommended Transit Management Plan. This matrix would be prepared by the Applicant and would consider the entire duration of the planned port call by the LNG vessel. Where sustained winds are forecast to exceed 25 knots at any time during the port call, the LNG vessel would be required to remain at least 50 nautical miles from the coast. Additional considerations would include the weather conditions that require calling a Pilot to attend an LNG vessel that is at the terminal, when a Pilot must remain on board during the transfer of LNG to the facility, and the weather considerations that would call for a suspension of the transfer operation and the subsequent departure from port of the LNG vessel. Once prepared, this matrix would be submitted to the Coast Guard for review and inclusion in the overall Transit Management Plan. Additional simulation studies may be required to validate the proposed weather matrix.
  - The Transit Management Plan will be reviewed within six months of the first arrival, and followed by an annual review to ensure that it reflects the most current conditions and procedures.
  - For at least the first six months, that there be at least two Pilots aboard the LNG vessel throughout the transit.
  - For at least the first six months, that all transits be completed during daylight hours only, unless approved in advance by the COTP. After the first six months, it is anticipated that night transits may be recommended at certain times of the year to minimize disruptions to the waterway from the CR buoy to buoy 12. These times include the busiest fishing seasons from June through September.
  - The LNG Vessel board Pilots at least 5 miles seaward of the CR Buoy.
  - Overtaking by or of the LNG Vessel is prohibited without COTP approval.
  - Meeting situations of commercial vessels will be closely controlled. All meetings to be pre-arranged via Channel 13 VHF Bridge-to-Bridge and would be limited to the following areas:
    - Commercial piloted vessels avoid meeting in all turns (excluding fishing vessels under 200 feet).
    - Weather and bar conditions permitting, vessels may arrange for meetings to occur between the CR buoy and buoy 12, and between buoy 25 and buoy 27.
  - 24 hours prior to arrival, the Coast Guard, FBI, Bar Pilots and River Pilots, Escort Tug Masters, and other Escort assets would meet to coordinate inbound and outbound transit details. Subsequent coordination meetings or phone call confirmation would be required 4 hours prior to arrival and 1 hour prior to arrival.
  - Vessel transits and bar crossings would be coordinated so as to minimize conflicts with other deep draft vessels, recreational boaters, seasonal fisheries, and other Marine Events.

Resource Gaps: The recommended Vessel Transit Management Plan would be approved by the COTP at least 60 days prior to the first arrival.

- Vessel Traffic Information System: The current Vessel Traffic Information System on the Columbia River is limited to AIS receivers and a handful of cameras. In order to ensure vessel safety and security, this capability would need to be augmented with a robust camera system capable of monitoring the entire transit route. Due to weather concerns, these cameras would be equipped with detectors capable of monitoring vessel traffic in wind, rain and fog conditions common on the river.

  Resource Gaps: Camera system with complete coverage of the entire transit route, capable of detecting vessel traffic in wind, rain, fog, and dark conditions. Access to the feed of this system should be granted to local, regional, state, and federal emergency responders.

- Tug Escort and Docking Assist : Due to the confined channel and high wind conditions, each LNG Carrier would be escorted by two tractor tugs, which would join the vessel as soon as safe to do so. Both tugs would be tethered at the direction of the Pilot. A third and fourth tractor tug would be required to assist with turning and mooring.
  - All four tugs will be at least 75 Ton Astern Bollard Pull or larger and equipped with Class 1 Fire Fighting equipment.
  - Based on the Maneuvering Simulation Study of January 3, 2008, LNG vessels would be limited to transiting during periods of 25 knots of wind or less. Additionally, extreme wind and weather conditions may require a third escort tug for any LNG vessel.
  - While unloading, all four tugs would remain on station to assist with emergency departure procedures. Two of the standby tugs would remain at the ready in the terminal basin, monitoring passing vessel traffic and immediately available to assist if maneuverability casualties of a passing vessel occurs. Whenever these tugs are utilized to assist a passing vessel, the Coast Guard would be notified as soon as it is safe to do so.
  - Tug escorts would be made in accordance with recognized industry standards, practices, or port guidelines that are developed specifically for "Tug Escorts."
  - "Best Achievable Protection" must be incorporated into tug and facility best practices. "Best Achievable Protection" means the highest level of protection which can be achieved through both the use of the best achievable technology and those manpower levels, training, procedures, and operational methods which provide the greatest degree of protection achievable.

  Resource Gaps: Four 75 Bollard Ton Tractor Tugs with Class 1 Fire Fighting capability. Tug escort standards and practices would be developed and implemented for LNG Carriers operating on the Columbia River in concert with the Coast Guard Sector Portland Harbor Safety Committee. "Best Achievable Protection" will require review and concurrence of the Harbor Safety Committee.

- Navigational Aids: Any additional aids to navigation would be privately funded and maintained by the Applicant, and the location and permitting would be accomplished in accordance with current Coast Guard and Corps of Engineers procedures:

- PORTS (Physical Oceanographic Real-Time System) station at the terminal site contracted with NOAA to provide real time river level, current and WX data
- A telemetric wind speed meter sited at the proposed terminal. In addition to providing the terminal and Operation Centers with current wind speeds, this meter would transmit data to the National Weather Service in accordance with NWS procedures.
- Doppler docking station.
- The available data for river current speeds at the terminal location is limited and unreliable. The installation of a turning basin by dredging the river bottom will impact the current data. As soon as practical after the dredging is complete and preferably before the final orientation of the pier face is completed, a river current study is recommended in the vicinity of the pier.
- A quick-release mooring system is recommended to allow for vessel departures on short notice without the aid of additional personnel ashore.
- Facility light shielding is recommended to preventing interfering with other Columbia River vessel traffic.

- <u>LNG Carrier familiarization training for Pilots and Tug Operators</u>: Prior to the arrival of the first vessel, joint simulator training is recommended for Pilots and Tug Operators identified as having responsibility for LNG traffic.

- <u>Dynamic Under Keel Clearance System:</u> Installation of a real time system for data collection on under keel clearance is strongly recommended and will increase the ability to safely navigate the Columbia River Bar in varying conditions. The lack of accurate data, will limit the conditions under which a vessel may safely transit the bar. An immersion study of deep draft LNG vessels transiting the bar during summer and winter conditions is recommended within the first 12 months.

  Resource Gap: Actual data on LNG tanker immersion.

Safety Measures:

- <u>Vessel and Facility Inspections</u>: LNG tankers and facilities are subject to (at a minimum) annual Coast Guard inspections to ensure compliance with federal and international safety, security and pollution regulations. In addition, LNG vessels and facilities are typically required to undergo a transfer monitor.

  Resource Gap: Additional Coast Guard Facility and Vessel Inspectors.

- <u>Shore-Side Fire-Fighting:</u> Firefighting capability is extremely limited along the entire transit route. Shore side firefighting resources and training would need to be augmented in order to provide basic protection services to the facility as well as the communities along the transit route.

  Resource Gap: To be determined in conjunction with local, regional, and state response agencies through the Emergency Response Planning process. Prior to the approval of the Emergency Response Plan (ERP), adequate cost sharing arrangements for project related training, equipment, maintenance, and staffing will need to be addressed for all of the communities impacted by the project.

- In-Transit Fire-Fighting: It is recommended that all crew members assigned to the escort and assist tugs be trained in the use and limitations of the installed Class I firefighting systems. Significant resource and jurisdictional issues exist in any marine fire incident on an underway vessel in the Columbia River. Current planning and preparedness efforts focus on a shore based response to a vessel moored at a facility.

  Resource Gap: Development of a concrete plan for managing underway firefighting, including provisions for command and control of tactical fire fighting decisions as well as financial arrangements for provision of required training, mutual aid and identification of suitable locations for conducting fire fighting operations is critical to ensuring the safety of the port and securing the waterway.

- Public Notification System and Procedures: Adequate means to notify the public along the transit route, including ongoing public education campaigns, emergency notification systems (such as reverse 911 and siren systems), and adequate drills and training are recommended. Education programs must be tailored to meet the various needs of all river users, including commercial and recreational boaters, local businesses, local residents, and tourists.

  Resource Gap: Current public notification capabilities vary greatly, and as part of the ERP process, a comprehensive notification system, including the deployment of associated equipment and training, will need to be developed in conjunction with local, regional, and state emergency responders.

- Gas Detection Capability: With the exception of the HAZMAT team in Astoria, gas detection capability is not resident and may not be available to initial responders along the transit route and at the facility. Emergency response personnel (both Police and Fire) require appropriate gas detection equipment, maintenance, and training.

  Resource Gap: Gas Detectors, appropriate training, and maintenance infrastructure to be developed as part of the ERP process in conjunction with local, regional, and state emergency responders.

- Communication Systems and Protocols: Inter-agency communications pose a significant obstacle to joint operations. Deployment of a Regional Communication Plan and associated equipment is recommended to ensure that the facility, associated command centers, emergency responders, Coast Guard, Tug Operators, Escort Vessels, and Pilots can communicate in an effective manner. The system should provide for monitoring and communicating on both secure and unsecure (e.g. Ch. 16, 13, 22), as well as sending and receiving both speech and data.

  Resource Gap: Operation specific and contingency communications plans and appropriate (intrinsically safe) equipment to coordinate both routine escorts and emergency operations. Equipment to transmit and receive both voice and data in a secure and unsecure environment. These gaps will be addressed as part of the ERP process in conjunction with local, regional, and state emergency responders.

Security Measures:

- Security Boardings, Waterway Monitoring, Shoreline Patrols, and Vessel Escorts: Extensive security measures will be recommended to provide adequate protection for LNG vessel while transiting the Columbia River and moored at the facility. The details of these measures are Sensitive Security Information, and are outlined in a separate supplementary analysis.

- Facility Security Measures: LNG facilities are subject to the security regulations outlined in 33 CFR 105, and are required to submit a Facility Security Plan (FSP) for Coast Guard approval, and undergo (at a minimum) an annual Coast Guard security inspection. The facility should also develop a plan to provide for appropriate security measures from the start of construction through implementation of the Coast Guard approved FSP.

In the absence of the risk mitigation measures proposed by the Applicant as modified and clarified by the measures described in this analysis and the resources necessary to implement them, or in the absence of any changes to existing Coast Guard policy or guidance to lessen safety and security requirements, the Columbia River would be considered unsuitable for the LNG marine traffic associated with the Oregon LNG terminal. Due to the dynamic nature of the Columbia River, the applicant should be required to submit an annual update to the Waterway Suitability Assessment to the Coast Guard which will be revalidated by the COTP and AMSC. For further information, please contact Mr. Russ Berg of Coast Guard Sector Portland at (503) 240-9374.

Sincerely,

F. G. MYER
Captain, U.S. Coast Guard
Captain of the Port
Federal Maritime Security Coordinator

Copy: Oregon LNG
Thirteenth Coast Guard District (dp)
Coast Guard Pacific Area (Pp)
Commandant, Coast Guard Headquarter (CG-5222) (CG-741) (CG-544)
Commander, MLCPAC (sm) (le)

U.S. Department of Homeland Security
United States Coast Guard

Commandant
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16475
MAY 1 2009

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St., NE, Room 1A
Washington, DC 20426

Dear Secretary Bose:

This letter is sent to advise you of a serious concern we have regarding conditions in your agency's Commission Order related to LNG vessels which are intended for use in connection with the LNG import terminal proposed for operation on the Columbia River at Bradwood in Clatsop County, Oregon (Bradwood Landing). Specifically, we are concerned about the conditions regarding the design requirements and use of various fish screening devices for water intake systems on LNG vessels. The devices broadly fit into two general categories – those that would require some design, construction or equipment modification to the LNG vessel, and those that would lay alongside or near the vessel, rather than on the vessel itself. The systems that cause the greatest concern to the Coast Guard are those systems that require design and construction changes or equipment to be installed onto the LNG vessels, such as fish screens attached directly to the vessel or the installation of equipment and piping in the vessel to accommodate shore-side supplied screened water hook-ups.

As indicated in the Environmental Impact Statement for Bradwood Landing and as outlined in the 2004 Interagency Agreement signed by our agencies, the Coast Guard has a significant role and interest in the regulation of vessels, including safety, security, environmental protection, and design. The Coast Guard has a long history of developing design and engineering standards for U.S. vessels and for working with the international community through the International Maritime Organization to develop universal design and operational standards for U.S. and foreign vessels engaged in international trade.

With regard to the biological concerns expressed by the Oregon Department of Fish and Wildlife (ODFW) and the National Marine Fisheries Service (NMFS), we recognize that ship based water intake systems and other intake systems may have potential biological impacts. We appreciate that resource agencies wish to reduce any potential impacts that water intake systems on LNG carriers calling on this facility may have, but clearly their concerns must be balanced with the safety and security of the vessels and must be accomplished in such way that doesn't improperly place restrictions on vessels that are fully in compliance with international design standards. The Coast Guard does not question FERC's authority to condition the LNG facility's siting, construction, or design so as to mitigate potential impacts. However, neither the Commission nor those other agencies has authority to exercise regulatory control (as a condition of the facility siting or operating permit or otherwise) over the LNG vessels calling at LNG facilities, including vessel operations, manning, equipment, design, or reporting. This includes imposing water intake design and screening requirements for vessels as part of the conditions in FERC's orders for proposed LNG facilities. Rather, regulation of such vessels is generally, and in many cases exclusively, reserved to the Coast Guard as a matter of law.

We would like to remind the Commission of some general limitations on agency control and responsibility related to this matter. Endangered Species Act (ESA) consultation requirements apply to actions over which an agency has discretionary involvement or control.[1] The ESA does not broaden an agency's authorities.[2] Accordingly, the effects analysis and any conditions imposed by the Commission should be addressed to activities by the Bradwood Landing facility which are subject to the Commission's jurisdiction.[3]

We agree with the remarks of dissenting FERC chairman Wellinhoff's statements that; 1) the evidence does not support a finding that the planned screening system will effectively mitigate the project's impact on sensitive aquatic resources to a less than significant level, 2) the application of fish screens on LNG carriers is a novel concept, 3) the use of fish screen technology on irrigation canals, industrial and municipal water supply pipes, and hydropower projects is not necessarily transferable to LNG carriers, and 4) the conceptual proposal for external screening for unmodified LNG carriers is particularly incomplete and uncertain.[4] We also would note the Columbia River currently experiences approximately two thousand (2000) deep draft ships every year or four thousand (4000) river transits, as well as a plethora of tow boats and other commercial and recreational vessels that are not subject to the same stringent fish screening standards.

As previously noted, the Coast Guard also has concerns with other water intake systems, such as LNG vessels being retrofitted to use a water delivery system to receive screened water from the facility, the on-site permeable curtain system, and an electric fish barrier. Any system that requires a vessel to install new equipment or operate in a manner different from its approved design standard should be vetted by the Coast Guard to ensure the requirements are safe for the

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[1] 16 U.S.C. § 1536(a)(2) (consultation required for "agency action"); 50 C.F.R. § 402.03 (consultation limited to actions subject to discretionary federal involvement or control); Defenders of Wildlife v. Norton, 257 F.Supp.2d 53, 67 (D.D.C. 2003) (discussing limitation on consultation where agency lacks control over third party action).
[2] Se Platte River Whooping Crane Critical Habitat Maint. Trust v. FERC, 962 F.2d 27, 34 (D.C. Cir. 1992)("As the Commission explained, the statute directs agencies to "utilize their authorities" to carry out the ESA's objectives; it does not expand the powers conferred on an agency by its enabling act."); American Forest & Paper Ass'n v. EPA, 137 F.3d 291, 298-99 (5th Circuit. 1998); Defenders of Wildlife v. Gutierrez, 2007 WL 1004242 (D.D.C. Apr. 5, 2007).
[3] See generally Natural Resources Defense Council, Inc. v. United States Envtl. Protection Agency, 859 F.2d 156, 170 (D.C. Cir. 1988) (EPA prohibited from imposing permit conditions unrelated to the discharge of a pollutant); Natural Resources Defense Council, Inc. v. United States Envt. Protection Agency, 822 F.2d 104, 130 (D.C. Cir. 1987); United States v. Mango, 199 F.3d 85, 93 n.7 (2nd Cir. 1999) (Corps permits may not set conditions on "entire activity involving the discharge;" conditions must be related to the discharge); c.f. Kokajko v. U.S.F.E.R.C, 873 F.2d 419 (1st Cir. 1989)("Commission has been consistent in its refusal to exercise regulatory power over non-project land and facilities").
[4] See page 94 of the Bradwood FERC Final Order

vessel and will be in compliance with the international standards. Furthermore, we believe the use of any of these untested and internationally unrecognized water intake systems may have negative consequences for vessel safety and security as well as adverse economic impacts. These include:

Reduction in cargo offload capacity: If the facility water delivery system or vessel fish screening system results in reduced ballast intake, the ship will need to compensate by slowing the offload rate thereby remaining in port for longer periods of time. This will potentially result in more cumulative effects on the environment;

Potential for power loss: Ship electrical power relies on water for generator cooling. If this is reduced or interrupted by any of these methods, a blackout would occur and remove critical systems such as cargo monitoring, fire fighting and lifesaving thereby placing the vessel and port community at greater risk of danger. Accordingly, any requirements that may affect critical vessel systems must be carefully evaluated and ultimately approved by authorities familiar with LNG vessel designs; namely recognized classification societies and vessel flag states;

Screen Sizes: The size of intake systems varies from ship to ship. Accordingly, only specific ships that are pre-designed and purpose built for accepting the proposed screening systems would be capable of calling at the facility. This excludes a large number of vessels from free market trade with the U.S.;

Emergency Disconnect: Vessels must be capable of departing the pier quickly in the event of an emergency. Pipelines connected directly to a vessel from a shore supplied water system would delay vessel departures and endanger the ship, her crew, and the port community. Therefore, at a minimum, any such system would need to be appropriately vetted and approved for such capability;

Emergency Offload: In the event that an emergency offload of LNG is needed from an LNG vessel, the LNG facility should be capable of receiving LNG without restrictions imposed on their water intake systems;

Firefighting: The vessel must have a sufficient water supply at all times for cooling as well as firefighting. The firefighting system is designed to deliver a water spray curtain based on a known intake rate from the sea and any potential obstruction restricting the water intake system could diminish the vessels overall ability to fight a fire thereby jeopardizing the vessel, and crew.

By agreeing with the recommendations of the ODFW and the NMFS, to require fish screens on water intake systems or for any new equipment requirements, your actions will create conflicts with international conventions. We believe this sends the wrong international message and establishes precedent which may create hardships for U.S. flagged vessel engaging in commercial trade in foreign waters. We believe such requirements may be more appropriately developed through official rulemaking and international agreements before being imposed as mandatory measures through a FERC order. For this and the reasons stated above, we strenuously object to the imposition of any requirements related to the design of vessel water intake systems that are not based on sound science, prescribed by recognized classification society standards or U.S. and International rules, and have not been approved by a vessel's flag state.

We request that you remove and/or refrain from imposing any requirements related to vessel water intake systems on any LNG vessel until such time that there are U.S. and International regulations in place that address intake requirements on all vessels. Should FERC, the resource agencies and the applicant choose to study and develop voluntary alternative means to reduce or mitigate the potential impacts, we stand ready to assist in ensuring that any proposed measures would not create unsafe conditions for the vessel or impose inappropriate requirements on US or foreign flag vessels.

Please do not hesitate to contact us if you would like to discuss further. My point of contact for this matter is Commander Patrick W. Clark, Chief, Vessel and Facility Operating Standards Division. He may be reached at the number and email address listed above.

Sincerely,

J G Lantz

J. G. LANTZ
U.S. Coast Guard
Director, Commercial Regulations and Standards
By direction

Copy: Commanding Officer, Sector Portland
Commander, Thirteenth Coast Guard District (p)
Commander, Pacific Area (p)
Commandant (CG-0941)
Commandant (CG-0942)
Commandant (CG-521)

APPENDIX B2

MEETINGS HOSTED BY OREGON LNG AND NORTHWEST

Table B2-1

Meetings Hosted by Oregon LNG and Northwest

Date	Location	Purpose	Attendees
Oregon LNG			
7/8/2008	Conference Call	Stream Crossing Subgroup Meeting	FERC, FWS, ODFW, Oregon LNG, CTGR
8/14/2008	Conference Call	Stream Crossing Subgroup Meeting	FERC, ODF, ODFW, CTGR, ODFW, NMFS, Oregon LNG, FWS
11/21/2008	Portland, OR	Habitat Categorization Subgroup	FERC, ODFW, Oregon LNG, ODF, FWS
12/2/2008	Portland, OR	Mitigation Subgroup	FERC, ODFW, CTGR, ODSL, FWS, ODLCD, EPA
12/2/2008	Portland, OR	Interagency Group	FERC, Coast Guard, CRITFC, ODFW, Oregon LNG, CTGR, ODSL, NMFS, Tillamook County Department of Community Development, ODLCD, ODE, City of Hillsboro, FWS
12/9/2008	Portland, OR	Fish Terminal Subgroup	FERC, Coast Guard, Oregon LNG, NMFS, ODFW, CRITFC
12/17/2008	Conference Call	Stream Crossing Subgroup	FERC, ODFW, ODSL, NMFS, FWS
1/16/2009	Portland, OR	Washington Agency	FERC, WA Ecology, WA ORA, WDFW, Wahkiakum County, ODLCD, CREST, USACE, ODE, EPA, NMFS, ODFW, WDNR
1/22/2009	Portland, OR	Stream Crossing Subgroup	FERC, FWS, ODFW, ODEQ, Oregon LNG, CTGR, ODSL, EPA, NMFS
2/3/2009	Portland, OR	Interagency Group	FERC, Oregon LNG, Coast Guard, EPA, NMFS, ODLCD, ODFW, ODE, CTGR, ODSL, ODF, FWS
2/3/2009	Portland, OR	Fish Terminal Subgroup	FERC, Oregon LNG, EPA, NMFS, ODFW
2/3/2009	Portland, OR	Dredging Subgroup	FERC, Oregon LNG, NMFS, EPA, ODFW
2/11/2009	Portland, OR	Fish Terminal Subgroup	FERC, Coast Guard, Oregon LNG, ODFW, NMFS
2/26/2009	Portland, OR	Stream Crossing Subgroup	FERC, ODFW, NMFS, ODF, FWS, EPA
3/20/2009	Portland, OR	Stream Crossing Subgroup	FERC, FWS, ODFW, Oregon LNG, CTGR, ODSL, EPA, NMFS, ODF, USACE
3/23/2009	Portland, OR	Dredging Subgroup	FERC, CRITFC, Oregon LNG, USACE, NMFS, ODLCD, WA Ecology
4/1/2009	Conference Call	Fish Terminal Subgroup	FERC, Oregon LNG, NMFS, ODFW
5/5/2009	Conference Call	Fish Terminal Subgroup	FERC, Oregon LNG, Coast Guard, NMFS, ODFW, Wy'East Marine, CRITFC
5//7/2009	Portland, OR	Stream Crossing Subgroup	FERC, FWS, ODFW, Oregon LNG, CTGR, ODSL, NMFS, USACE
8/12/2009	Portland, OR	Mitigation Subgroup	FERC, Oregon LNG, ODFW, NMFS, FWS
9/9/2009	Portland, OR	Fish Terminal Subgroup	FERC, Oregon LNG, NMFS, Coast Guard, USACE, FWS, EPA, CTGR, ODFW, ODFW
10/7/2009	Portland, OR	Mitigation Subgroup	FERC, Oregon LNG, ODFW, Coast Guard, ODFW, CRITFC, WDFW, NMFS
2/9/2010	Portland, OR	Mitigation Subgroup	FERC, Oregon LNG, NMFS, FWS, USACE, EPA, ODFW, ODSL, CTGR
4/14/2011	Conference Call	Discuss ESA Section 7 Consultation Process	FERC, NMFS, Oregon LNG
9/5/2012	Portland, OR	Stream Crossing Subgroup	FERC, Oregon LNG, NFMS, EPA, USACE, FWS, ODSL, ORA, ODFW, Cowlitz County, WA UTC, WDOE, WA Ecology
9/6/2012	Portland, OR	Dredging Subgroup	FERC, Oregon LNG, EPA, USACE, NMFS, ODSL, ODLCD, ORA, WA Ecology

Table B2-1

Meetings Hosted by Oregon LNG and Northwest

Date	Location	Purpose	Attendees
10/23/2012	Columbia County, OR	Stream Crossing Subgroup	FERC, Oregon LNG, EPA, NMFS, USACE, FWS, ODFW, CTGR
10/30/2012	Cowlitz County, WA	Stream Crossing Subgroup	FERC, NMFS, WDFW, ORA, USACE, FWS, WDNR, NMFS
11/07/2012	Deer Island, Columbia County, OR	Stream Crossing Subgroup	FERC, WDFW, Dyno Nobel, USACE, ODFW, FWS
11/4/2013	Lacey, WA Vancouver, WA Conference Call	Washington Permit Applications	FERC, FWS, NMFS, USACE, WA Ecology, ORA, WSDOT, WDFW, WDNR, WA UTC, City of Woodland, Cowlitz County, Northwest
Northwest			
10/17/2012	Lacey, WA	Interagency Meeting	FERC, Northwest, USACE, NMFS, FWS
12/3/2013	Lacey, WA	JARPA Pre-application Meeting	FERC, Northwest, USACE, WA Ecology
4/21-25/2014	WA	Waterbody Crossing Site Review	FERC, Northwest, WA Ecology, WDFW, FWS, NMFS, WDNR
8/18-21/2014	WA	Wetland Crossing Site Review	FERC, Ecology, WDFW, Northwest
11/19/2014	Whatcom County, WA	Recreation and Conservation Areas of Interest Site Review	FERC, Northwest, Whatcom County Land Trust

Coast Guard	U.S. Coast Guard
CRITFC	Columbia River Inter-Tribal Fish Commission
CTGR	Confederated Tribes of Grand Ronde
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission or HDR Inc. representing FERC
FWS	U.S. Fish and Wildlife Service
NMFS	National Marine Fisheries Service
Northwest	Northwest Pipeline LLC
ODE	Oregon Department of Energy
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODLCD	Oregon Department of Land Conservation and Development
ODSL	Oregon Department of State Lands
ORA	Washington Governor’s Office of Regulatory Assistance
USACE	U.S. Army Corps of Engineers
WA Ecology	Washington State Department of Ecology
WA UTC	Washington Utilities and Transportation Commission
WDFW	Washington State Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources

APPENDIX B3

SUMMARY OF TRIBAL CONSULTATIONS

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
Affiliated Tribes of Northwest Indians		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Lynn Dennis.		No response to NOI filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Lynn Dennis.		No response to NOI filed with FERC.
Columbia River Inter-Tribal Fish Commission		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Olney Patt, Executive Director; Rob Lothrup; Julie Carter, Policy Analyst; Patti Howard, Water Quality Coordinator; and Jamie Pinkham.	Sent letter about LNG import project to CRITFC on June 28, 2007. Telephone contact on October 5, 2007. Meetings with CRITFC on November 5, 2007, and in August 2008.	No response to NOI filed with FERC.
Sent NOI for export project issued September 24, 2012.		No response to NOI filed with FERC.
	Sent letter on May 16, 2012, to Paul Lumley, Executive Director of CRITFC, about the export project and request for information.	No comments on export project filed with FERC.
	Sent copy of cultural resources survey report to Paul Lumley on August 12, 2013.	No comments on report filed with FERC.
Chehalis Confederated Tribes		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o David Burnett, Chair.		No response to NOI filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o David Burnett, Chair; Nancy Romero, Cultural Resources; and Mark White, Natural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to David Burnett, Chair.		No response to letter filed with FERC.
Chinook Nation		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Gary Johnson, Chair.		No response to NOI filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Ray Gardner, Chair.		No response to NOI filed with FERC.
Clatsop-Nehalem Confederated Tribes		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Joseph Scovell.		No response to NOI filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Joseph Scovell		No response to NOI filed with FERC.

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
Cow Creek Band of Umpqua Tribe of Indians		
FERC staff met with representatives of Cow Creek Band on January 24, 2008.		
Cowlitz Indian Tribe		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o John Barnett, Chair; Ted Sprague, President Economic Council; and Mike Iyall, Natural Resource Director.		No response to NOI filed with FERC.
Sent letter about LNG import project on October 22, 2007 to John Barnett, Chair		No response to letter filed with FERC.
	Sent letter on May 16, 2012, to Dave Burlingame, Cultural Resources Director of Cowlitz Tribe, about the export project and request for information.	No response to the Oregon LNG letter filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o John Barnett, Chair; Mike Iyall, Natural Resources; and Ed Arthur, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to William Iyall, Chair.		Cowlitz Tribe sent FERC an email on April 24, 2013 stating that the project is within the tribe's area of concern and an Inadvertent Discovery Plan should be part of the permit.
	Sent copy of cultural resources survey report to Cowlitz tribe on August 12, 2013.	No comments on report filed with FERC.
	Sent email on August 12, 2013 informing tribe of opportunity to participate in ethnographic studies.	No response filed with FERC.
Confederated Tribes of the Grand Ronde Community		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Cheryle Kennedy, Chair, and Khani Schultz, Cultural Resources.	Sent letters on June 28, 2007 and September 10, 2007 about LNG import project. Met with Grand Ronde Tribes on February 26 and May 30, 2008. Sent Grand Ronde Tribes copy of its draft Resource Report 4 on February 13, 2008.	In response to NOI, Grand Ronde Tribes requested meetings with FERC staff. Grand Ronde Tribes filed for intervenor status on February 12, 2009. Grand Ronde Tribes sent February 2, 2009 email to Oregon LNG stating tribe had no comments on survey report.
Sent letter about LNG import project on October 22, 2007 to Cheryle Kennedy, Chair		No response to letter filed with FERC.
FERC staff met with Grand Ronde representatives on January 24, February 25, and March 31, 2008.	Participated in meeting with FERC staff and Grand Ronde Tribes on January 24, 2008, February 25, 2008, and March 31, 2008.	Grand Ronde Tribes requested ethnographic study, and monitors for survey in Woodburn area.

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
Sent NOI for export project issued September 24, 2012 c/o Brandy Humphreis, Khanai Shultz, Michael Karnesh, Eirik Thorsgard, and David Lewis.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Reynold Leno, Chair.		In response to the letter, the Grand Ronde Tribes sent an email to FERC staff on January 18, 2013 requesting a copy of the cultural resources survey report.
	Sent letter on May 16, 2012, to Eirik Thorsgard, Cultural Resources Director for Grand Ronde Tribes, about the export project and request for information.	No comments on export project filed with FERC.
	Sent copy of cultural resources survey report to Eirik Thorsgard on August 12, 2013.	No comments on report filed with FERC.
	On August 12, 2013, called Eirik Thorsgard to inform tribe of the opportunity to participate in ethnographic studies.	No response filed with FERC.
Kikiulus Indian Tribe		
Sent NOI for export project issued September 24, 2012 c/o Kurt Weinreich, Cultural Resources.		No response to NOI filed with FERC.
Lummi Nation		
Sent NOI for export project issued September 24, 2012 c/o Merle Jefferson, Natural Resources, and Lena Tso, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Clifford Cultee, Chair.		No response to letter filed with FERC.
Muckelshoot Tribe		
Sent NOI for export project issued September 24, 2012 c/o Virginia Cross, Chair; Karen Walter, Habitat Program; and Melissa Calvert, Preservation Department.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Virginia Cross, Chair.		No response to letter filed with FERC.
Nez Perce Tribe		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Rebecca Miles, Chair; Gary Green, Executive Committee; Randall Minthorn, Execitive Committee; and Ryan Sudbury, Attorney.	Sent letter to Nez Perce Tribe on March 12, 2008.	No response to NOI filed with FERC.
Sent letter about LNG import project on October 22, 2007 to Samuel Penny, Executive Committee.		No response to letter filed with FERC.

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
	Sent letter on May 16, 2012, to Vera Sonneck, Cultural Resources Director for Nez Perce Tribe, about the export project and request for information.	No response to Oregon LNG about export project filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Brooklyn Baptiste, Chair, and Ryan Sudbury, Legal		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Silas Whitman, Chair.		No response to letter filed with FERC.
	Sent copy of cultural resources survey report to Vera Sonneck on August 12, 2013.	No comments on report filed with FERC.
Nisqually Tribe		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Dorian Sanchez, Chair, and Thor Hoyte.		No response to NOI filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Dorian Sanchez, Chair.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Cynthia Iyall, Chair		No response to letter filed with FERC.
Nooksack Tribe		
Sent NOI for export project issued September 24, 2012 c/o Robert Kelly, Chair; Greg MacWilliams, Natural Resources; and George Swanaset, Cultural Resources		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Robert Kelly, Chair		No response to letter filed with FERC.
Puyallup Tribe		
Sent NOI for export project issued September 24, 2012 c/o Herman Dillon, Chair; Brandon Reynon, Tribal Archaeologist; Joseph Anderson, Director Fisheries Department; and Bill Sullivan, Natural Resources.		In October 9, 2012 email to FERC staff, Puyallup Tribe requested additional information about the Washington Expansion Project (WEP) (see table B3-2 for WEP consultation).
Sent letter about export project on January 16, 2013 to Herman Dillon, Chair.		No response to letter filed with FERC.
Samish Nation		
Sent NOI for export project issued September 24, 2012 c/o Tom Wooten, Chair; Jacquelyn Ferry, Cultural Resources; and Christine Woodward, Natural Resources.		Samish Nation sent email to FERC staff on October 8, 2012, requesting copy of cultural resources report for Skagit County, Washington (WEP).
Sent letter about export project on January 16, 2013 to Tom Wooten, Chair.		Samish Nation sent email to FERC staff on February 4, 2013 again requesting the survey report (see table B3-2 for WEP consultation).

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
Sauk-Suiattle Tribe		
Sent NOI for export project issued September 24, 2012 c/o Norma Joseph, Chair; Dora Dailey, Cultural Resources; and Richard Wolten, Natural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Norma Joseph, Chair.		No response to letter filed with FERC.
Shoalwater Bay Tribe		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Charlene Nelson, Chair.		No response to NOI filed with FERC.
Sent letter about LNG import project on October 22, 2007 to Charlene Nelson, Chair.		No response to letter filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Charlene Nelson, Chair.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Charlene Nelson, Chair.		No response to letter filed with FERC.
	Sent copy of cultural resources survey report to Earl Davis, Cultural Resources for Shoalwater Bay Tribe, on August 12, 2013.	No comments on report filed with FERC.
	Sent email on August 12, 2013 informing tribe of opportunity to participate in ethnographic studies.	No response filed with FERC.
Confederated Tribes of Siletz Indians		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Delores Pigsley, Chair, and Robert Kentta, Cultural Resources.	Sent letters about LNG import project on June 28, 2007 and September 10, 2007.	In response to NOI, Siletz Tribes requested a meeting with FERC staff.
Sent letter about LNG import project on October 23, 2007 to Delores Pigsley, Chair		No response to letter filed with FERC.
FERC staff met with Siletz representatives on January 24, 2008.	Oregon LNG participated in January 24, 2008 meeting between FERC staff and Siletz Tribes.	Siletz Tribes requested ethnographic study.
	Sent letter on May 16, 2012, to Robert Kentta, Cultural Resources Director, about the export project and request for information.	No comments on export project filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Delores Pigsley, Chair, and Robert Kentta, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Delores Pigsley, Chair.		No response to letter filed with FERC.
	Sent copy of cultural resources survey report to Robert Kentta on August 12, 2013.	No comments on report filed with FERC.

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
	Sent email on August 12, 2013 informing tribe of opportunity to participate in ethnographic studies.	No response filed with FERC.
Snoqualmie Tribe		
Sent NOI for export project issued September 24, 2012 c/o Shelley Burch, Chair; Steven Mullen Moses, Director Archaeology & Historic Preservation; and Cindy Spiry, Natural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Shelly Burch, Chair.		No response to letter filed with FERC.
Stillaguamish Tribe		
Sent NOI for export project issued September 24, 2012 c/o Shawn Yanity, Chair; Tara Duff, Cultural Resources; Jay Harvey, Cultural Resources; and Pat Stevenson, Natural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Shawn Yanity, Chair.		No response to letter filed with FERC.
Suquamish Indian Tribe		
Sent NOI for export project issued September 24, 2012 c/o Leonard Forsman, Chair.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Leonard Forsman, Chair.		No response to letter filed with FERC.
Swinomish Tribal Community		
Sent NOI for export project issued September 24, 2012 c/o M. Brian Cladoosby, Chair, and Charles O'Hara, Director Planning & Environment.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Brian Cladoosby, Chair.		In letter to FERC dated February 13, 2013, the Swinomish Tribal Community indicated that it would participate in the Pre-filing process to the extent practicable.
Tulalip Tribes of the Tulalip Reservation		
Sent NOI for export project issued September 24, 2012 c/o Melvin Sheldon, Chair, and Hank Gobin, Director Cultural Center.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Melvin Sheldon, Chair.		No response to letter filed with FERC.

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
Confederated Tribes of the Umatilla Indian Reservation		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Antone Minthorne, Chair; Carey Miller, THPO; Bruce Zimmerman; and Carl Merkle, Salmon Policy Analyst		No response to NOI filed with FERC.
Sent letter about LNG import project on October 23, 2007 to Antoine Minthorn, Chair.		No response to letter filed with FERC.
	Sent letter on May 16, 2012, to Teara Farrow, Cultural Resources Director, about the export project and request for information.	No comments on export project filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Eric Quaempti, Board of Trustees; Carey Miller; and Teara Farrow, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Les Minthorn, Chair.		No response to letter filed with FERC.
	Sent copy of cultural resources survey report to Catherine Dickson on August 12, 2013.	No comments on report filed with FERC.
Upper Skagit Indian Tribe		
Sent NOI for export project issued September 24, 2012 c/o Jennifer Washington, Chair.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Jennifer Washington, Chair		No response to letter filed with FERC.
Confederated Tribes of the Warm Springs Reservation		
Sent NOI for Oregon LNG import project issued August 24, 2007 c/o Ron Suppah, Chair, and Sally Bird, Cultural Resources.	Sent letters about import project on June 28, 2007 and September 10, 2007. CH2M HILL met with Warm Springs Tribes on February 26, 2008.	In response to the NOI, Warm Springs Tribes requested a meeting.
Sent letter about LNG import project on October 22, 2007 to Ron Suppah, Chair		No response to letter filed with FERC.
FERC staff met with Warm Springs representatives on January 24, February 25, and March 31, 2008.	Participated in meeting with FERC staff and Warm Springs Tribes on January 24, 2008, February 25, 2008, and March 31, 2008.	Warm Springs Tribes requested ethnographic study.
	Sent letter on May 16, 2012, to Sally Bird, Cultural Resources Director, about the export project and request for information.	No comments on export project filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Ron Suppah, Chair, and Sally Bird, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Stanley Smith, Chair		No response to letter filed with FERC.
	Sent copy of cultural resources survey report to Sally Bird on August 12, 2013.	No comments on report filed with FERC.

Table B3-1

Summary of Tribal Consultations for the Oregon LNG Project

Native Americans or Tribes Contacted by FERC	Native Americans or Tribes Contacted by Oregon LNG	Responses
	On August 12, 2013, called Sally Bird to inform tribe of the opportunity to participate in ethnographic studies.	No response filed with FERC.
Confederated Tribes and Bands of the Yakama Nation		
Oregon LNG Project NOI issued August 24, 2007 c/o Jerry Meninick, Chair.		No response to NOI filed with FERC.
Sent letter about LNG import project on October 22, 2007 to Lavina Washines, Chair.		No response to letter filed with FERC.
	Sent letter on May 16, 2012, to Johnson Mennick, Cultural Resources Director, about the export project and request for information.	No comments on export project filed with FERC.
Sent NOI for export project issued September 24, 2012 c/o Jerry Mennick, Chair; Johnson Mennick, Cultural Resources; and Philip Rigdon, Natural Resources.		No response to NOI filed with FERC.
Sent letter about export project on January 16, 2013 to Harry Smiskin, Chair.		No response to letter filed with FERC.
	Sent copy of cultural resources survey report to Johnson Mennick on August 12, 2013.	No comments on report filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
Affiliated Tribes of Northwest Indians		
Sent NOI for WEP issued September 24, 2012 c/o Lynn Dennis.		No response to NOI filed with FERC.
Columbia River Inter-Tribal Fish Commission		
Sent NOI for WEP issued September 24, 2012.		No response to NOI filed with FERC.
Chehalis Confederated Tribes		
Sent NOI for WEP issued September 24, 2012 c/o David Burnett, Chair; Nancy Romero, Cultural Resources; and Mark White, Natural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Burnett describing WEP and including its cultural resources research design.	No response to letter filed with the FERC.
Sent letter about WEP on January 16, 2013 to David Burnett, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) on September 24, 2013 to Richard Bellon, Cultural Resources and Mark White, Natural Resources.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Chinook Nation		
Sent NOI for WEP issued September 24, 2012 c/o Ray Gardner, Chair.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Gardner describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
	Sent cultural resource survey report, (McClintock et al. June 2013) on September 24, 2013 to Ray Gardner, Chair, and Tony Johnson, Cultural Resources.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
Clatsop-Nehalem Confederated Tribes		
Sent NOI for WEP issued September 24, 2012 c/o Joseph Scovell		No response to NOI filed with FERC.
Cowlitz Indian Tribe		
Sent NOI for WEP issued September 24, 2012 c/o John Barnett, Chair; Mike Iyall, Natural Resources; and Ed Arthur, Cultural Resources.	.	No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Iyallt describing the WEP and including its cultural resources research design.	No response to letter filed with FERC
Sent letter about WEP on January 16, 2013 to William Iyall, Chair.		The Cowlitz Indian Tribe sent FERC an email on April 24, 2013 stating that the project is within the tribe's area of concern and provided recommended language regarding the Inadvertent Discovery Plan.
	Sent cultural resource report (McClintock et al June 2013) on September 24, 2013 to Ed Arthur and Dave Burlingame of Cultural Resources, and Taylor Aalvik of Natural Resources.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Duwamish Tribe		
	Sent revised addendum survey report on September 3, 2014.	No comments on report filed with FERC.
Confederated Tribes of the Grand Ronde Community		
Sent NOI for WEP issued September 24, 2012 c/o Brandy Humphries, Khanai Shultz, Michael Karnesh, Eirik Thorsgard, and David Lewis.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Kennedy describing WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Reynold Leno, Chair.		In response to the letter, the Grand Ronde Tribes sent an email to FERC staff on January 18, 2013 requesting a copy of the cultural resources survey report for Oregon LNG Project (see table B3-1 for Oregon LNG Project consultation).
	Sent cultural resource survey report (McClintock et al. June 2013) to David Lewis and Eirik Thorsgard, Cultural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
Kikiallus Indian Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Kurt Weinreich, Cultural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Administrator Weinreich describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Administrator Weinreich on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014	No comments on report filed with FERC.
Lummi Nation		
Sent NOI for WEP issued September 24, 2012 c/o Merle Jefferson, Natural Resources, and Lena Tso, Cultural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Cultee describing WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Clifford Cultee, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Lena Tso, Cultural Resources, and Merle Jefferson, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014	No comments on report filed with FERC.
Muckleshoot Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Virginia Cross, Chair; Karen Walter, Habitat Program; and Melissa Calvert, Preservation Department.		In November 7, 2012 letter, the Muckleshoot Indian Tribe Fisheries Division Habitat Program provided comments and requested that FERC work directly with the Muckleshoot Indian Tribe to determine potential impacts on fisheries and riparian areas. The Tribe requested that copies of the Draft EIS be sent to three departments at the Muckleshoot Indian Tribe: Fisheries, Cultural/Preservation, and Planning.
	Sent letter on September 28, 2012 to Chair Cross describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Virginia Cross, Chair.		No response to letter filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
	Sent cultural resource survey report (McClintock et al. June 2013) to Laura Murphy, Cultural Resources, and Karen Walter, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report on September 3, 2014	No comments on report filed with FERC.
Nez Perce Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Brooklyn Baptiste, Chair, and Ryan Sudbury, Legal		No response to NOI filed with FERC.
Sent letter about WEP on January 16, 2013 to Silas Whitman, Chair.		No response to letter filed with FERC.
Nisqually Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Dorian Sanchez, Chair.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Iyall describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Cynthia Iyall, Chair		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Joe Kalama and Fabio Apolito, Cultural Resources, and David Troutt, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014	In September 8, 2014 letter, the Nisqually Indian Tribe stated that it had reviewed the report and had no further information or concerns at this time, but would want to be informed if there are any inadvertent discoveries of archaeological resources or human remains.
Nooksack Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Robert Kelly, Chair; Greg MacWilliams, Natural Resources; and George Swanaset, Cultural Resources		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Kelly describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Robert Kelly, Chair		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to George Swanaset, Cultural Resources, and Gary MacWilliams and Jeffery Thomas, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Puyallup Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Herman Dillon, Chair; Brandon Reynon, Tribal Archaeologist; Joseph Anderson, Director Fisheries Department; and Bill Sullivan, Natural Resources.		In an October 9, 2012 email to FERC staff, the Puyallup Tribe requested additional information regarding the WEP impacts on the Puyallup Tribe's usual and accustomed area.
	Sent letter on September 28, 2012 to Chair Dillon describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Herman Dillon, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Bill Sullivan, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Samish Nation		
Sent NOI for WEP issued September 24, 2012 c/o Tom Wooten, Chair; Jacquelyn Ferry, Cultural Resources; and Christine Woodward, Natural Resources.		Samish Nation sent an email to FERC staff on October 8, 2012, requesting a copy of the cultural resources report for Skagit County, Washington.
	Sent letter on September 28, 2012 to Chair Wooten describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Tom Wooten, Chair.		Samish Nation sent an email to FERC staff on February 4, 2013 again requesting a copy of the survey report.
	Sent cultural resource survey report (McClintock et al. June 2013) to Jacky Ferry, Cultural Resources, and Christine Woodward, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	In September 4, 2014 and September 18, 2014 emails to Northwest, Samish Nation stated it was not interested in consulting on the project,
Sauk-Suiattle Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Norma Joseph, Chair; Dora Dailey, Cultural Resources; and Richard Wolten, Natural Resources.		No response to NOI filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
	Sent letter on September 28, 2012 to Chair Hoffman describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Norma Joseph, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Norma Joseph, Cultural Resources, and Richard Wolten, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Shoalwater Bay Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Charlene Nelson, Chair.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Nelson describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Charlene Nelson, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Earl Davis and Tony Johnson, Cultural Resources, and Gary Burns, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Confederated Tribes of Siletz Indians		
Sent NOI for WEP issued September 24, 2012 c/o Delores Pigsley, Chair, and Robert Kentta, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about WEP on January 16, 2013 to Delores Pigsley, Chair.		No response to letter filed with FERC.
Snohomish Tribe		
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Snoqualmie Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Shelley Burch, Chair; Steven Mullen Moses, Director Archaeology & Historic Preservation; and Cindy Spiry, Natural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Burch describing the WEP and including its cultural resources research design.	Snoqualmie Indian Tribe sent an email to Northwest on October 18, 2012, requesting more information about the project and maps.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
Sent letter about WEP on January 16, 2013 to Shelly Burch, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Stephen Mullen-Moses, Cultural Resources, and Cindy Spiry, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014	No comments on report filed with FERC.
Steilacoom Tribe		
	Sent letter on September 28, 2012 to Chair Marshall describing the WEP and including its cultural resource research design. .	No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Danny Marshall, Chair, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014	No comments on report filed with FERC.
Stillaguamish Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Shawn Yanity, Chair; Tara Duff, Cultural Resources; Jay Harvey, Cultural Resources; and Pat Stevenson, Natural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Yanity describing WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Shawn Yanity, Chair.		No response to letter filed with FERC.
	Sent electronic copies of the prefiling versions of Resource Reports 1 and 4 to Kerry Lyste on February 15, 2013.	No comments filed with the FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Jay Harvey, Cultural Resources, and Pat Stevenson, Natural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Suquamish Indian Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Leonard Forsman, Chair.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Forsman describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Leonard Forsman, Chair.		No response to letter filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
	Sent cultural resource survey report (McClintock et al. June 2013) to Dennis Lewarch, Cultural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Swinomish Tribal Community		
Sent NOI for WEP issued September 24, 2012 c/o M. Brian Cladoosby, Chair, and Charles O'Hara, Director Planning & Environment.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Cladoosby describing the WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Brian Cladoosby, Chair.		In a letter to FERC dated February 13, 2013, the Swinomish Tribal Community indicated that it would participate in the Pre-filing Process to the extent practicable.
	Sent cultural resource survey report (McClintock et al. June 2013) to Larry Campbell, Cultural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Tulalip Tribes of the Tulalip Reservation		
Sent NOI for WEP issued September 24, 2012 c/o Melvin Sheldon, Chair, and Hank Gobin, Director Cultural Center.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Sheldon describing WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Melvin Sheldon, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Richard Young, Cultural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Confederated Tribes of the Umatilla Indian Reservation		
Sent NOI for WEP issued September 24, 2012 c/o Eric Quaempti, Board of Trustees; Carey Miller; and Teara Farrow, Cultural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Minthorn describing the WEP and including its cultural resources research design.	
Sent letter about WEP on January 16, 2013 to Les Minthorn, Chair.		No response to letter filed with FERC.

Table B3-2

Summary of Tribal Consultations for WEP

Native Americans and Indian Tribes Contacted by FERC	Native Americans and Indian Tribes Contacted by Northwest	Responses
	Sent cultural resource survey report (McClintock et al. June 2013) to Teara Farrow and Catherine Diickson, Cultural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Upper Skagit Indian Tribe		
Sent NOI for WEP issued September 24, 2012 c/o Jennifer Washington, Chair.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Washington describing WEP and including its cultural resources research design.	No response to letter flied with FERC.
Sent letter about WEP on January 16, 2013 to Jennifer Washington, Chair		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Scot Schuyler, Cultural Resources, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.
Confederated Tribes of the Warm Springs Reservation		
Sent NOI for WEP issued September 24, 2012 c/o Ron Suppah, Chair, and Sally Bird, Cultural Resources.		No response to NOI filed with FERC.
Sent letter about WEP on January 16, 2013 to Stanley Smith, Chair		No response to letter filed with FERC.
Confederated Tribes and Bands of the Yakama Nation		
Sent NOI for WEP issued September 24, 2012 c/o Jerry Mennick, Chair; Johnson Mennick, Cultural Resources; and Philip Rigdon, Natural Resources.		No response to NOI filed with FERC.
	Sent letter on September 28, 2012 to Chair Smishin describing WEP and including its cultural resources research design.	No response to letter filed with FERC.
Sent letter about WEP on January 16, 2013 to Harry Smiskin, Chair.		No response to letter filed with FERC.
	Sent cultural resource survey report (McClintock et al. June 2013) to Kate Valdez, Cultural Resources, and Philip Rigdon, Natural Resouces, on September 24, 2013.	No comments on report filed with FERC.
	Sent revised addendum survey report (McClintock and Wilt September 2014) on September 3, 2014.	No comments on report filed with FERC.

APPENDIX C

SAFETY ADVISORY REPORT AND MOU BETWEEN OREGON LNG AND OREGON DEPARTMENT OF ENERGY

Appendix C1: Response of the Federal Energy Regulatory Commission to the Safety Advisory Report of the Oregon Department of Energy for the Oregon LNG Terminal Project and ODE Safety Advisory Report

Appendix C2: MOU between Oregon LNG and ODE

APPENDIX C1

RESPONSE OF THE FEDERAL ENERGY REGULATORY COMMISSION TO THE SAFETY ADVISORY REPORT OF THE OREGON DEPARTMENT OF ENERGY FOR THE OREGON LNG TERMINAL PROJECT AND ODE SAFETY ADVISORY REPORT

1.0 INTRODUCTION

The Natural Gas Act (NGA), as modified by the Energy Policy Act of 2005 (EPAct), requires that the Federal Energy Regulatory Commission (FERC or the Commission) consult with the state in which a liquefied natural gas (LNG) terminal is proposed to be located regarding state and local safety matters. The governor of Oregon designated the Oregon Department of Energy (ODE) as the state agency that the FERC should consult with on safety and siting matters for the Oregon LNG Terminal and Pipeline Project. On November 10, 2008, the ODE submitted its Safety Advisory Report to the FERC. In the report, ODE addressed state and local considerations for the project.

The EPAct also stipulates that before the Commission may issue an order authorizing an LNG terminal, it must "review and respond specifically" to the safety matters raised by the state agency designated as the lead for the state and local safety matters. Table C1-1 of this appendix provides the FERC's response to the ODE Safety Advisory Report for the Oregon LNG Terminal Project. Section 3.0 contains the Safety Advisory Report.

2.0 FERC RESPONSE TO THE SAFETY ADVISORY REPORT

The ODE identified the following key categories of potential safety concerns in the Safety Advisory Report:

- Emergency Planning and Response;
- Security Zone;
- Seismic Design;
- Terminal Design;
- Hazard Identification;
- Quality Assurance;
- Safety Issues; and
- Emergency Response Capabilities near the Facility Location.

The Safety Advisory Report included both general and specific safety matters that ODE requested to be included in the FERC's review of the Oregon LNG application. The FERC's specific responses to those concerns are presented in tabular format in table C1-1 in the order of the issues presented in the report. Where appropriate, the response identifies the section of the EIS where information on the issue of concern is addressed.

As described in sections 1.0 and 2.1 of the EIS, the Coast Guard has shared responsibility with FERC in reviewing the Oregon LNG Terminal Project and has summarized portions of its review in its Letter of Recommendation (LOR). In addition to including the LOR in the EIS, we have summarized portions of it in the EIS. As a result, for some concerns presented in the Safety Advisory Report, we have noted that the issue is addressed in the LOR, as well as the specific section of the EIS where the concern is addressed.

TABLE C1-1

The FERC's Responses to Concerns Presented in the ODE Safety Advisory Report for the Oregon LNG Terminal Project

Topic	Issue	Response
Emergency Planning and Response	The FERC should require an applicant to commit to covering 100 percent of the safety and security costs directly associated with the LNG vessel transits, the facility, and the pipeline.	We included a recommendation that the Emergency Response Plan include a Cost-Sharing Plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. This is discussed in section 4.1.13.9 of the EIS.
	The safety/security zones proposed for the vessel in transit and the vessel at dock must be sufficiently calculated and justified. The applicant or the Coast Guard must thoroughly explain any changes to those zones that might accompany heightened national security as well as any resulting impacts.	In its LOR Analysis, the Coast Guard has recommended a 500-yard moving safety/security zone around the LNG carrier during transit of the waterway where no other vessel may enter without first obtaining permission from the COTP. While the ship is moored at the terminal, there will be a 200-yard security zone around the vessel. The expectation is that the Captain of the Port's (COTP) Representative would work with the pilots and patrol assets to control traffic, and would allow vessels to transit the Safety/Security zone based on a case-by-case assessment conducted on the scene. Escort resources would be used to contact and control vessel movements such that the LNG carrier is protected.
	The FERC should require the applicant to complete an acceptable Emergency Response Plan prior to any Commission decision on its application and in conjunction with the Coast Guard's validation of the WSA. The applicant's Emergency Response Plan must be developed in full cooperation with state and local authorities. The applicant's Emergency Response Plan must sufficiently and accurately characterize the emergency response capabilities along the vessel transit route and near the facility, including response times and must include measures to mitigate for any safety gaps.	In accordance with the Energy Policy Act of 2005, this plan must be filed prior to any project construction. We included a recommendation in section 4.1.13.9 that, prior to initial site preparation, Oregon LNG should develop an Emergency Response Plan (including evacuation) and coordinate procedures with the Coast Guard; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies.
	The applicant's Emergency Response Plan must include all potentially affected communities along the LNG vessel route and near the terminal in a comprehensive, thoroughly publicized warning system. The applicant's Emergency Response Plan must account for potential population increases due to tourism.	Part of the Emergency Response Plan (to be developed by Oregon LNG) must include at a minimum: procedures for notifying residents and recreational users within areas of potential hazard and locations of permanent sirens and other warning devices. Also, the recommendation we included in section 4.1.13.9 would require the involvement of local emergency planning groups in developing the Emergency Response Plan.

TABLE C1-1

The FERC's Responses to Concerns Presented in the ODE Safety Advisory Report for the Oregon LNG Terminal Project

Topic	Issue	Response
	Any FERC authorization for an LNG terminal and associated pipeline in Oregon must fully comply with Oregon state and local laws and regulations, including energy facility siting laws.	As a matter of foreign commerce, the importation or exportation of LNG is subject to federal, not state, control. Although the Commission has exclusive jurisdiction over the proposed project, certain permits, approvals, and licenses are the responsibility of other federal agencies and state and local authorities. The Commission encourages cooperation between project applicants and these agencies. However, any state or local permits issued with respect to the jurisdictional facilities authorized by the Commission must be consistent with the conditions of the approving Order.
Seismic Design	The Oregon Department of Geology (DOGAMI) has recommended that the design basis tsunami height be raised and concerns over the liquefiable soils at the terminal site be addressed.	In the DEIS, Section 4.1.1.1, subsections titled Seismic-related Hazards, Seismic-induced Subsidence, Tsunami, and Soil Liquefaction and Settlement provide a detailed description of the design basis for the tsunami height and addresses concerns over liquefiable soils at the Project. The design height is based upon a site specific tsunami study prepared by Coast and Harbor in 2013. This analysis predicts that the design tsunami elevation would range between +8 and +16 feet (NAVD 88) at the terminal site considering the tsunami occurred at mean high water tidal elevation. It is estimated during the CSZ earthquake, the terminal site would lower 7.6 feet due to tectonic subsidence. Therefore the effective water surface elevation would range between +15.6 feet and +23.6 feet considering tsunami wave, tidal, and subsidence effects. Earthquake hazard maps of the Astoria-Warrenton area (DOGAMI, 1999) indicate that the terminal area has a high risk for soil liquefaction. Oregon LNG's geotechnical assessment (CH2M HILL, 2013a) concluded that settlement of up to 2.4 feet may occur from liquefaction at the terminal during a large earthquake. The design basis return period is 2500 years.
Terminal Design	In Oregon LNG's application, Resource Report 11 references the 2001 edition of NFPA 59A, but the NFPA website states that the current edition is 2009. FERC should use the latest edition as its acceptance criteria.	On April 9, 2004, the DOT revised 49 CFR 193 to incorporate the 2001 edition of NFPA 59A. Portions of the 2006 edition of NFPA 59A, related to storage tank seismic design, have also been incorporated into 49 CFR 193. To date, the DOT has not incorporated the 2009 edition into the CFR and FERC will continue to use the approved criteria in its review process.
Hazard Identification	In Oregon LNG's application, Resource Reports 1 and 11 state that the terminal would be designed to accommodate ships with capacities up to 250,000 m^3. The reference at the end of Resource Report 11 includes the original 2004 Sandia Report that reports the zones of concern based on ships smaller than 150,000 m^3. FERC should base its analysis on the most recent Sandia Report and include a recommendation to limit ships to be no larger than those assumed in any heat flux and vapor dispersion calculations.	The Coast Guard has taken into account the hazards associated with larger ships in accordance with NVIC 01-11 which references Sandia 2008. Sandia 2008 specifically addresses larger ships such as those being proposed by Oregon LNG. The updated Sandia report is discussed in Section 4.1.13.7.

TABLE C1-1

The FERC's Responses to Concerns Presented in the ODE Safety Advisory Report for the Oregon LNG Terminal Project

Topic	Issue	Response
	The FERC should verify that the assumption of pure methane cargoes is not representative of actual cargoes and may not be conservative.	The presence heavier hydrocarbons such as ethane and propane and imported LNG with concentrations from 86 to 96 percent methane are discussed in section 4.1.13.6 of the EIS.
Quality Assurance	The State of Oregon expects the Commission to describe and impose a condition requiring Oregon LNG to adopt a rigorous and comprehensive quality assurance program applicable during both construction and operation of the import terminal.	Quality assurance and control programs to monitor material selection, equipment fabrication, and installation would be provided by the Engineering, Procurement, and Construction (EPC) contractor selected by the project applicant if the project is authorized. In addition, the applicant would also have a similar program to provide oversight of the EPC. FERC staff would review these programs during periodic construction inspections. We have also included a condition requiring Oregon LNG to provide its quality assurance and quality control plans for our review and approval. During the operational phase of the proposed terminal, Oregon LNG would be required to file with the Secretary semi-annual operational reports that identify changes in facility design and operating conditions, abnormal operating experiences, activities (including ship arrivals, quantity and composition of imported LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans, and progress thereof. The proposed terminal would also be subject to regular FERC staff technical reviews and site inspections on at least an annual basis or more frequently if circumstances indicate.
Safety Issues	The California Energy Commission advisory report for the proposed Long Beach import terminal suggests a lower heat flux level of 1.5 kw/m^2. Oregon LNG should calculate the distance to this heat flux level for a design basis event and issue a figure showing the results.	The DOT examined this issue during the rulemaking process which established the thermal exclusion zone requirements. In their Advance Notice of Proposed Rulemaking (Notice No. 77-4, Docket No. OPSO-46), which was used to develop 49 CFR Part 193, the DOT suggested 3.1 kw/m^2 (1,000 Btu/ft^2-hr) as an acceptable level for direct human exposure to thermal flux. After the public review period, it was determined that the evidence and information supported the use of 5 kw/m^2 (1,600 Btu/ft^2-hr) as the limit for direct human exposure. Also, in a formal interpretation issued on July 7, 2010, DOT confirmed that the thermal flux levels prescribed in the 2001 edition of NFPA 59A comply with the regulations in 49 CFR 193.2057.

TABLE C1-1

The FERC's Responses to Concerns Presented in the ODE Safety Advisory Report for the Oregon LNG Terminal Project

Topic	Issue	Response
Additional Comments on the Associated Pipeline	The pipeline associated with OLNG goes through more populated lands than the Pacific Connector pipeline that was associated with JCEP. FERC should take into account the rapid population growth close to Warrenton and in western Washington County, particularly near Forest Grove. The same comment would apply to portions of Marion County near Woodburn. This would make it appropriate for FERC to require pipeline design and block valve spacing for a higher population category. Category 3 should be a minimum, and even category two design specifications would be appropriate in sections near these rapidly growing exurbs.	As described under pipeline safety in section 4.1.13.13 of the EIS, under a *Memorandum of Understanding on Natural Gas Transportation Facilities* dated January 15, 1993 between the DOT and FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of FERC's regulations requires that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection. Alternatively, an applicant must certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards for pipeline facilities.
	FERC should also note that in Oregon, the Public Utility Commission (OPUC) has inspection and enforcement authority for regulations of USDOT, under a delegation from USDOT. The OPUC has implemented pipeline safety regulations that include, and sometimes exceed, the USDOT regulations at 49 CFR 192. FERC should consult directly with the pipeline safety section of the OPUC for a full comparison. The State of Oregon expects that wherever there is a difference between USDOT and OPUC pipeline safety rules, the stricter of the two will apply.	Section 4.1.13.13 of the EIS states that Title 49, U.S.C. Chapter 601 provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards. A state may also act as DOT's agent to inspect interstate pipeline facilities within its boundaries; however, the DOT is responsible for enforcement actions In Oregon, the Public Utility Commission (OPUC) has inspection and enforcement authority for regulations of DOT, under a delegation from DOT. The OPUC has implemented pipeline safety regulations that include, and sometimes exceed, the USDOT regulations at 49 CFR 192.

TABLE C1-1

The FERC's Responses to Concerns Presented in the ODE Safety Advisory Report for the Oregon LNG Terminal Project

Topic	Issue	Response
Emergency Response Capabilities Near the Facility Location	The Emergency Response Plan must address all identified emergency situations, and that all costs attributable to insuring public safety must be borne by the applicant. The State is also concerned about the effect of impasse during negotiations for the Emergency Response Plan and urges the Commission to adopt a clear, expeditious process for addressing disagreements between the applicant and state and local governments.	In accordance with the Energy Policy Act of 2005, this plan must be filed prior to any project construction. We included a recommendation in section 4.1.13.9 that Oregon LNG develop an Emergency Response Plan (including evacuation) and coordinate procedures with the Coast Guard; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. The EIS includes a Cost-Sharing Plan that would identify the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. As an update in an email communication from the ODE to FERC on October 30, 2014 (FERC eLibrary Accession number 20141103-4002), ODE staff indicates that Oregon LNG has committed to development of the Memorandum of Understanding, and the development of the plans and programs included in the MOU. ODE staff indicates that the negotiated MOU would specify documents to be developed and executed by ODE and Oregon LNG in order for ODE to reach a determination that the emergency preparedness approach committed to by Oregon LNG meets state safety and security standards, including, but not limited to: 1) Emergency Response Plan; 2) Resource List that identifies gaps in personnel, facilities, equipment and systems needed to implement the ERP; and 3) Cost-Share Agreement with state and local agencies for activities and resources identified in the ERP and Resource List.
	FERC should make the development of the Emergency Response Plan as transparent to the public as possible, including the essential elements of the plan. Although details of the WSA and Emergency Response Plan are withheld from public disclosure, information regarding measures to protect the public during an event should be a part of public outreach and should be available before the issuance of a FERC construction permit.	Information in the Emergency Response Plan pertaining to items such as off-site emergency response and procedures for public notification and evacuation would be subject to public disclosure. See section 4.1.13.9 of the EIS.

Oregon

Theodore R. Kulongoski, Governor

OREGON DEPARTMENT OF ENERGY

VIA Electronic Filing

November 10, 2008

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426
Re: Oregon LNG Project, Docket No. CP09-6 and CP09-7

Dear Ms. Bose:

On October 10, 2008, Oregon LNG filed an application for construction of a terminal for importation of liquefied natural gas (LNG). Oregon LNG will be an onshore LNG receiving terminal on the east bank of the Skipanon Peninsula near the confluence of the Skipanon and Columbia Rivers at Warrenton, Clatsop County, Oregon. The proposed facility includes a turning basin and berth for unloading LNG carriers and facilities to receive and regasify LNG.

The sendout pipeline associated with this project is the proposed Oregon Pipeline, approximately 121 miles of 36-inch pipeline from Warrenton to Molalla OR. This pipeline will interconnect at the Molalla Gate Station near Molalla, Oregon, with other natural gas pipelines including Northwest Natural Gas Co.'s South Mist Pipeline Extension and Williams' Northwest Pipeline.

The pipeline design includes one electrically driven gas compressor station just south of the Timber area on Longview Fiber land in Washington County, Oregon.

The Energy Policy Act of 2005, enacted on August 8, 2005, specifies in Section 311(d) that the Governor of a state where a proposed LNG terminal would be located shall designate a state agency to consult with the Federal Energy Regulatory Commission regarding applications and that this state agency may prepare a safety advisory report that addresses state and local safety considerations. This provision in the Energy bill appears to be specific to the terminal and not to any associated pipeline. The report is due 30 days from the application filing date.

The Governor of Oregon has designated the Oregon Department of Energy as the agency responsible for preparation of a safety advisory report for the proposed Bradwood Landing LNG terminal. Therefore, enclosed for filing in the above-mentioned proceeding, please find an electronic copy of the safety advisory report for the proposed LNG terminal. If you have any questions in this matter, please contact Tom Stoops at (503) 378-8328 or tom.stoops@state.or.us.

Sincerely,

Ken Niles, Assistant Director
Nuclear Safety and Energy Facility Siting

SAFETY ADVISORY REPORT

ON THE PROPOSED
OREGON LNG LIQUEFIED NATURAL GAS TERMINAL

SKIPANON PENSINSULA
NEAR WARRENTON, OREGON

PREPARED BY THE STAFF
OF THE OREGON DEPARTMENT OF ENERGY

November 10, 2008

SAFETY ADVISORY REPORT ON THE PROPOSED OREGON LNG LIQUEFIED NATURAL GAS TERMINAL SKIPANON PENSINSULA NEAR WARRENTON, OREGON

The Oregon Department of Energy (ODOE) issues this Safety Advisory Report on behalf of the State of Oregon pursuant to section 311(d) of the Energy Policy Act of 2005 (the Act). The report concerns the application to the Federal Energy Regulatory Commission (FERC) by Oregon LNG, LLC, to build an onshore LNG receiving terminal on the east bank of the Skipanon Peninsula near the confluence of the Skipanon and Columbia Rivers at Warrenton, Clatsop County, Oregon. The proposed facility includes a turning basin and berth for unloading LNG carriers and facilities to receive and regasify LNG and a 121 mile sendout pipeline from Warrenton to Molalla OR. Oregon LNG filed its application with FERC on October 10, 2008.

The Act allows the state to file an advisory report that identifies "state and local safety considerations" within 30 days of the date the application is filed. The "safety" information solicited in the advisory report is largely repetitive of information that Oregon LNG itself provides in its application to FERC in its terminal application and in its Waterway Suitability Assessment to the Coast Guard. It is information that Oregon LNG also must provide in its emergency response plan to be developed in conjunction with the Coast Guard, the state, and appropriate local jurisdictions prior to any construction.

The State of Oregon has been intimately involved in reviewing and commenting on Oregon LNG's pre-filing and application resource reports, and is involved with the Coast Guard in reviewing the project's WSA. To the extent that the State disagrees with the information Oregon LNG has provided or will provide on safety issues in those venues, the state will pursue corrections or changes through the above review processes. For example, Oregon LNG has not accurately or adequately characterized in its Waterway Suitability Assessment (WSA) the area's emergency response capabilities. The Department will work with the Coast Guard, other state agencies and local jurisdictions to correct the information under the WSA process.

The State considered providing FERC with specific scenarios for evaluating accidental or intentional releases of LNG from a vessel or the facility itself. Again, however, such scenarios play a role both in the WSA and in the forthcoming emergency response planning. Moreover, based on recent Commission approvals of LNG terminal projects, the State believes the Commission will find that the risk of any potential LNG release scenario can be reduced to an acceptable minimum.

On June 15, 2006, the Commission approved three new LNG terminal projects: Sempra's Port Arthur LNG in Port Arthur, Texas; Cheniere's Creole Trail LNG in Cameron Parish, Louisiana; and BP America Production Company's Crown Landing LNG in Logan Township in New Jersey. The language in the Commission's Creole Trail decision about the risk of an accidental LNG release is mirrored in the other two decisions:

> Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and the local pilots, a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the FEIS determined that the risk to the public from accidental causes is negligible.

Further, the language in the Commission's Creole Trail decision about the risk of an intentional LNG release is also mirrored in the other two decisions:

> Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility. For a new LNG import terminal proposal having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack is a serious concern of the local population and requires that resources be directed to mitigate possible attack paths. If the Coast Guard issues a Letter of Recommendation finding the waterway suitable for LNG marine traffic, the operational restrictions that would be imposed by the Lake Charles Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose, would minimize the possibility of a hazardous event occurring along the vessel transit area. While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, we are confident that they can be reduced to minimal levels and that the public will be well protected from harm.

For the above reasons, what the State provides in this advisory report largely is broad safety policy statements about the proposed Oregon LNG project along with a limited amount of specific, technical comments. In addition, the State is attaching one letter each from the cities of Warrenton and Astoria and a package of information from Clatsop County for FERC's consideration. As well, the State of Oregon incorporates by reference the safety comments included in previous filings to the FERC docket, including CP06-365 Bradwood Landing and CP07-441 Jordan Cove.

Although the application to FERC is limited in scope to the LNG terminal and associated pipeline, we consider the risks from a release of LNG on the mouth of the Columbia River to be among the most significant safety concerns associated with the facility. The safety of the LNG terminal is strongly connected to the question of safety on the waterway and in the nearby communities of Warrenton and Astoria.. We expect FERC to address issues and concerns raised by stakeholders in those communities and to consider the safety of those communities in determining whether to approve the LNG terminal and associated pipeline.

Each of the state and local agencies in Oregon, whether or not they contributed to this advisory report, reserve their right to file additional joint or separate comments and/or evidence on safety and other issues.

State of Oregon General Policy Comments

1. **FERC should require an applicant to commit to 100 percent of the safety and security costs directly associated with the LNG vessel transits, the facility and the pipeline.**
   Under Section 311(e)(2), an emergency response plan to be developed prior to construction must include a cost-sharing plan that includes a "description of any direct cost reimbursements that the applicant agrees to provide to any State and local agencies with responsibility for security and safety at the LNG terminal and in proximity to vessels that serve the facility." The State understands and appreciates that Oregon LNG has agreed thus far to pick up the costs of most safety and security needs that the company has identified as necessary. However, the local jurisdictions are not in a position to dedicate their own limited funds to any LNG safety and security measures that may be required. In addition, local jurisdictions may not agree with an applicant about the level of resources required. An applicant should first be required to pay for an adequate assessment of safety and security needs and then pay for all infrastructure, planning, emergency exercises and other associated costs identified in an emergency response plan agreed to by the state and local jurisdictions. Should FERC not require the applicant to commit to 100 percent of the costs, FERC should explain its authority for imposing such costs on local jurisdictions and the state.

2. **The safety/security zones proposed for the vessel in transit and the vessel at dock must be sufficiently calculated and justified. The applicant or Coast Guard must thoroughly explain any changes to those zones that might accompany heightened national security as well as any resulting impacts.**
   Some area residents have expressed concern that the safety/security zones will be so large that they will impact traffic on the Columbia River. Others have expressed concern that the safety/security zones will be too small, sized to avoid the above concern rather than for adequate safety protection. Any zones proposed should provide a rationale for their size.

3. **FERC should require an applicant to complete an acceptable emergency response plan prior to any Commission decision on an application and in conjunction with the Coast Guard's validation of the Waterway Suitability Assessment.**
   Under Section 311(e)(1), FERC will not require Oregon LNG to create an emergency response plan until after a positive decision by the Commission and just before any final approval to begin construction. However, to the extent that Oregon LNG's Waterway Suitability Assessment relies on the creation of a satisfactory emergency response plan to ensure that the Columbia River is suitable for LNG, that emergency response plan must be available for review prior to any decisions on both the WSA and the FERC application. Again learning from the Bradwood Landing and the JCEP experience, the recommended conditions in the DEIS would require the applicant for that facility to develop the Emergency Response Plan (ERP) prior to construction, but after the Commission's decision to approve the project. It would be illogical for either the Commission or the Coast Guard to decide that LNG is safe for the region without knowing first if a suitable emergency response plan can be enacted along the vessel route and at the facility.

4. **The applicant's Emergency Response Plan must be developed in full cooperation with state and local authorities.**
   Emergency response planning must be an integrated, carefully developed effort that involves every entity that is potentially affected by the LNG import terminal.

5. **The applicant's Emergency Response Plan must sufficiently and accurately characterize the emergency response capabilities along the vessel transit route and near the facility, including response times. The Plan must mitigate for any safety gaps.**
Thus far, the state and local jurisdictions have not reached agreement as to which jurisdiction will have primary responsibility and authority in the event of an accident or intentional breach. Agreement also has not been reached on the resource gaps, and proper allocation of supplemental resources. The USCG and FERC should not find that the waterway is suitable until it is known that these issues have been resolved.

6. **The applicant's Emergency Response Plan must include all potentially affected communities along the LNG vessel route and near the terminal in a comprehensive, thoroughly publicized warning system.**
Any community located within one of the three Sandia zones of impact must be considered in emergency response plans, including access to a reverse 911 system and sirens.

7. **The applicant's Emergency Response Plan must account for potential population increase due to tourism.**
According to a 2004 Clatsop County Grand Jury Report, Clatsop County's population can increase by 50-to-100 percent or more during high tourism season. Depending on the location of those visitors, the influx may bring challenges for LNG emergency response education as well as LNG ship transit education.

8. **Any FERC authorization for an LNG terminal and associated pipeline in Oregon must fully comply with Oregon state and local laws and regulations, including energy facility siting laws.**
In particular, the State of Oregon requires large energy facilities to provide a bond or letter of credit to ensure that the proposed site can be restored to a useable, non-hazardous condition. We consider the bond or letter of credit to be a safety precaution against a potentially abandoned or otherwise vacated site. Thus far, the applicant does not appear to have addressed this issue in its application materials.

State of Oregon Specific Comments

Seismic Design

The Department is particularly concerned about the potential for tsunami. Of the three LNG terminals proposed along the Oregon coast since 2004, the Oregon LNG site is by far the most susceptible to tsunami. This is partly because the location facing the mouth of the Columbia is in the direct path of a design basis tsunami, with no breakwater or other shielding. Members of the Oregon Department of Geology (DOGAMI) went to Sumatra after the 2005 tsunami, and have recommended that design basis tsunami height be raised considerably. Also, DOGAMI has raised serious concern over the liquefiable soils at the terminal site. This is in contrast to other sites that were either several miles up the river, or located on more stable soils.

For this reason, any emergency plan proposed for the OLNG facility should be based on the premise that a tsunami could be the initiating event, and that emergency response capabilities will be challenged by the tsunami itself.

Terminal Design

Resource reports 1 and 11 consistently commit to compliance with NFPA 59A and codes referenced therein, but with little information on the actual details of compliance. Resource report 11 references the 2001 edition of NFPA 59A, but the NFPA website states that the current edition is 2009. FERC should use the latest edition as its acceptance criteria. Even if detailed design information were available, the short deadline for this advisory report does not permit a detailed design review, sufficient to audit Oregon LNG's design against NFPA code requirements on a line-by-line basis. We expect FERC to perform this detailed design review, and reserve the right to comment on design issues as more time and more information become available.

Hazard Identification

The safety discussion in Resource Report 11 appears to rely heavily on the 2004 Sandia Report, and particularly on the Zones of Concern identified in that report and cited in NVIC 05-05. The references at the end of Resource Report 11 include the original 2004 Sandia Report, but there is no mention of the more recent "Sandia II", which addresses larger ships. FERC should base its hazards analysis on the more recent recommendations of Sandia II.

Resource report 1 of Oregon LNG's application state sthat the terminal will be designed to accommodate ships with capacity up to 250,000 m^3 The zones of concern in the 2004 Sandia report were based on ships smaller than 150,000 m^3 FERC's recommendation for this project should be conditioned on ships no larger than those assumed in any heat flux and vapor dispersion calculation.

The assumption of pure methane is probably not representative of actual cargo and may not be conservative. Oregon LNG has not committed to receiving its supply from any particular producing nation, and therefore we must assume that product would be received from nations where the LNG has a higher concentration of natural gas liquids such as propane. Some of these higher-weight hydrocarbons have higher potential for vapor dispersion than pure methane. We expect FERC to verify that conservative assumptions were used for all parameters, including the hydrocarbon content of the product, in NFPA 59A required calculations. The EIS for this project should explain how these assumptions were made and why they are the most conservative.

Quality Assurance

In our Safety Advisory Report for Bradwood Landing, dated June 2006 and for JCEP, dated October 2007, ODOE included extensive comments on the need for a rigorous Quality Assurance program that would be subject to regulatory review prior to start of construction. We note that the Bradwood DEIS and FEIS as well as the JCEP DEIS do not include a discussion of such a program, and we renew the recommendation and incorporate our comments from that June 2006 report into this one. The State expects the Commission to describe and impose a condition requiring Oregon LNG to adopt a rigorous and comprehensive quality assurance program applicable during both construction and operation of the import terminal.

Our review of 49 CFR 193 and NFPA 59A did not reveal any standards for an acceptable QA program. We would expect to see evidence that the QA function is independent of operations, scheduling or budgeting. We would expect to see steps to ensure that:

- i metal components are fabricated of metals with the specified metallurgical content and properties,
- ii concrete or other structural materials are tested to the strength specified,
- iii vendors of equipment and material are audited by qualified auditors,
- iv nondestructive tests are observed and approved by independent quality control personnel,
- v personnel performing safety related construction or operation activities are properly qualified, with documentation of that qualification available for audit,
- vi construction and operations are performed in accordance with approved procedures,
- vii only controlled copies of design documents are used in construction, with only the current revision used in the field,
- viii all changes in design documents are carried forward to other related and associated design documents,
- ix measurements are made with equipment that is calibrated and traceable,
- x conditions adverse to quality are subject to a corrective actions program that results in actions to prevent recurrence.

Safety Issues

The State of Oregon has reviewed the Safety Advisory Report on the proposed LNG terminal at the Port of Long Beach (POLB) issued by the California Energy Commission (CEC). That report relies largely on material taken from two readily available reports: (1) the Sandia Labs' November 2004 report "Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water" (Sandia Report) and (2) Richard Clark's "LNG Facilities in Urban Areas."

The safety significant events listed in Sandia and Clark and quoted in the CEC advisory report could apply to any terminal at any location and need not be repeated in this report. However, we agree with CEC that the 5 kw/m^2 is described in the Sandia Report as "the permissible level for emergency operations lasting several minutes with appropriate clothing" (Table 6, p.38). This is the lowest heat flux shown in the tables that describe the exclusion zone calculations in Resource report 11.. Because the people occupying the nearest residences or businesses (in Warrenton) are relatively far from the nearest fire station and do not have the appropriate clothing or emergency training, thermal radiation calculations should show the point at which worst case heat flux will permit safe evacuation, possibly requiring more than "several minutes" and without appropriate clothing or emergency training. We especially note that U.S. highway 101 can reach a virtual standstill during weekends, even in winter, so that evacuation may not be quick or eve practical. Therefore, an exclusion distance should be chosen that ensures a low enough heat flux for those people who cannot move away quickly. The CEC advisory report at p. 15 suggests 1.5 kw/m^2. Oregon LNG should calculate the distance to this heat flux for a design basis event at Oregon LNG and issue a figure showing the results.

Additional Comments on the Associated Pipeline
Resource Report 11 includes substantive information on pipeline safety as well as terminal safety. The pipeline associated with OLNG goes through more populated lands than the Pacific Connector pipeline that was associated with JCEP. FERC should take into account the rapid population growth close to Warrenton and in western Washington County, particularly near Forest Grove. The same comment would apply to portions of Marion County near Woodburn. This would make it appropriate for FERC to require pipeline design and block valve spacing for a higher population category. Category 3 should be a minimum, and even category two design specifications would be appropriate in sections near these rapidly growing exurbs.

FERC should also note that in Oregon, the Public Utility Commission (OPUC) has inspection and enforcement authority for regulations of USDOT, under a delegation from USDOT. The OPUC has implemented pipeline safety regulations that include, and sometime exceed, the USDOT regulations at 49 CFR 192. For example, OPUC rules for cathodic protection exceed the federal regulations and require that such protection be operational immediately as start of operation, without the six month lag allowed by federal rules. There are other examples where PUC rules exceed those of USDOT. FERC should consult directly with the pipeline safety section of the OPUC for a full comparison. The State of Oregon expects that wherever there is a difference between USDOT and OPUC pipeline safety rules, the stricter of the two will apply.

Emergency Response Capabilities near the Facility Location
The State appreciates that the Commission has provided draft guidance for preparing the required Emergency Response Plan for an LNG import terminal. However, the State remains concerned that the guidance will be viewed by applicants as an upper limit on their responsibility for ensuring the safety of surrounding communities. The State views the guidance as just that: guidance, and urges the Commission to affirmatively state that the ERP must ERP must address all identified emergency situations, and that all costs attributable to insuring public safety must be borne by the applicant.

Furthermore, the State remains concerned that FERC's guidance fails to provide minimum resource and training standards for LNG emergency preparedness and response. The state is concerned about the effect of impasse during negotiations for the ERP. As a result, the state established minimum standards for any LNG developer desiring to build and operate an LNG import terminal in Oregon. The state urges the Commission to require Oregon LNG to establish a Memorandum of Understanding agreeing to comply with Oregon's minimum standards for emergency preparedness to prevent disagreements between the applicant and state and local governments on what is adequate LNG preparedness.

Finally, whatever criteria are used to generate the ERP, FERC should make the process as transparent to the public as possible, including the essential elements of an emergency plan. Although the details of the WSA and ERP are withheld from public disclosure, information regarding measures to protect the public during a design basis event should be a part of public outreach and should be available before the issuance of a FERC construction permit.

CERTIFICATE OF SERVICE AND MAILING

I hereby certify that I have this day served by electronic mail, and for those parties for which service is not specified at an electronic mail address, by U.S. mail, first class postage prepaid, the foregoing document on all parties listed on the official service list complied on this proceeding.

Date: November 10, 2008.

Janet L. Prewitt
Janet L. Prewitt, #85307
Assistant Attorney General

APPENDIX C2

MOU BETWEEN OREGON LNG AND ODE

AGREEMENT BETWEEN THE OREGON DEPARTMENT OF ENERGY AND OREGON LNG FOR EMERGENCY PLANNING AND PREPAREDNESS AT PROPOSED LNG FACILITIES

I. Purpose

This agreement establishes a framework of cooperation and sets responsibilities between Oregon LNG and the Oregon Department of Energy (ODOE) for the completion of Phase I and Phase II of the planning and preparedness for emergencies at proposed Liquefied Natural Gas (NG) facilities in Oregon. This includes the associated terminals and events along the waterway transit routes as described in Section IV of this agreement.

II. Authorities and Responsibilities

Oregon LNG is responsible by federal law and regulations to cooperate with state and local governments to protect public health and safety in the event of an accident at their LNG facilities, terminals, or along the transit routes.

The Governor of Oregon is responsible for the emergency services system within the state of Oregon (ORS 401.035). In consultation with the Oregon Department of Energy and the Economic and Community Development Department, the Governor is directed to prepare an extensive statewide contingency plan for energy emergencies (ORS 176.809) The Governor of the State of Oregon has delegated to ODOE the responsibility to work with the United States Coast Guard and be the lead state agency that will work with FERC with respect to safety issues associated with LNG facilities in Oregon. Pursuant to ORS 469.030(1) (c), (e) and U), ODOE has authority to contract with private agencies for energy activities and services related to energy resources including the administration of federal and state energy programs.

III. Objectives

Oregon LNG and ODOE agree to cooperate to develop an emergency preparedness program for accidents at proposed facilities, which establishes and ensures uniform policies and procedures to (1) protect public health, safety and the environment and (2) ensure public awareness of and confidence in Oregon's and Oregon LNG's response to an accident.

IV. Phase 1 Tasks

ODOE agrees to develop a program for carrying out the responsibilities listed in Section II as they apply to Oregon LNG's proposed LNG facility.

Oregon LNG and ODOE agree that Phase 1 will focus on developing a preliminary draft state LNG Emergency Response Plan. Phase 1 tasks include:

Task 1 – Review existing site-specific emergency response plans, along with Coast Guard waterway documentation. Participate in the development of site-specific emergency response plans and comment on documents provided for review.

Task 2 – Review existing site-specific information necessary to assist in the development of local and state emergency response plans, focusing on existing and needed infrastructure, personnel and equipment requirements, and communication protocols.

Task 3 – Review published emergency response plans from already constructed and permitted LNG re-gasification terminals within the United States to provide key structure and content information. Site-specific information will be updated based on construction information in Phase 2 before operations commence.

Task 4 – Develop the preliminary draft State Emergency Response plan with initial required procedures identified. Procedures will be drafted in phase 2, before operations commence.

Task 5 – Develop the preliminary draft site-specific information and define overarching procedure needs.

Task 6 – Publish preliminary draft State Emergency Response plan for review and revision by state and local agencies.

V. Consideration

A. In consideration of ODOE's activities under this agreement, Oregon LNG will reimburse ODOE for expenditures incurred in performance of the tasks described in Section IV above.
B. ODOE will submit quarterly invoices to Oregon LNG. Oregon LNG agrees to reimburse ODOE for all expenses incurred, including salaries, benefits, direct expenses for services and supplies, travel and indirect (overhead).
C. For the period beginning on the effective date of this contract and ending June 30, 2015, Oregon LNG will pay ODOE an amount not to exceed $25,000. The not-to-exceed amount can be revised by modification to this Agreement and must be signed by authorized representatives of both parties.

VI. Revisions

Oregon LNG and ODOE agree to review this agreement and update it as necessary. Amendments or modifications may be made to this agreement only upon the written agreement of both parties.

VII. Term of Agreement

This agreement shall become effective upon signatures by both parties, and shall remain in effect until June 30, 2015, unless sooner terminated or extended. This Agreement may be terminated by either party upon 30 days previous written notice to the other party.

The agreement is executed this 15th day of August, 2014.

VIII. Contract

ODOE Contact

Deanna Henry
Emergency Manger
Oregon Department of Energy
625 Marion St. NE
Salem, OR 97301

(503) 932-4428
deanna.henry@state.or.us

Oregon LNG Contact

Peter Hansen
Chief Executive Officer
Oregon LNG
5 N HWY 101
Warrenton, OR 97146

(503) 298-4967
peterh@oregonlng.com

OREGON DEPARTMENT OF ENERGY

8.19.14
Michael Kaplan — Date
Deputy Director

8/18/14
Jan Lemke — Date
Designated Procurement Officer

8-18-14
Ken Niles, — Date
Division Administrator

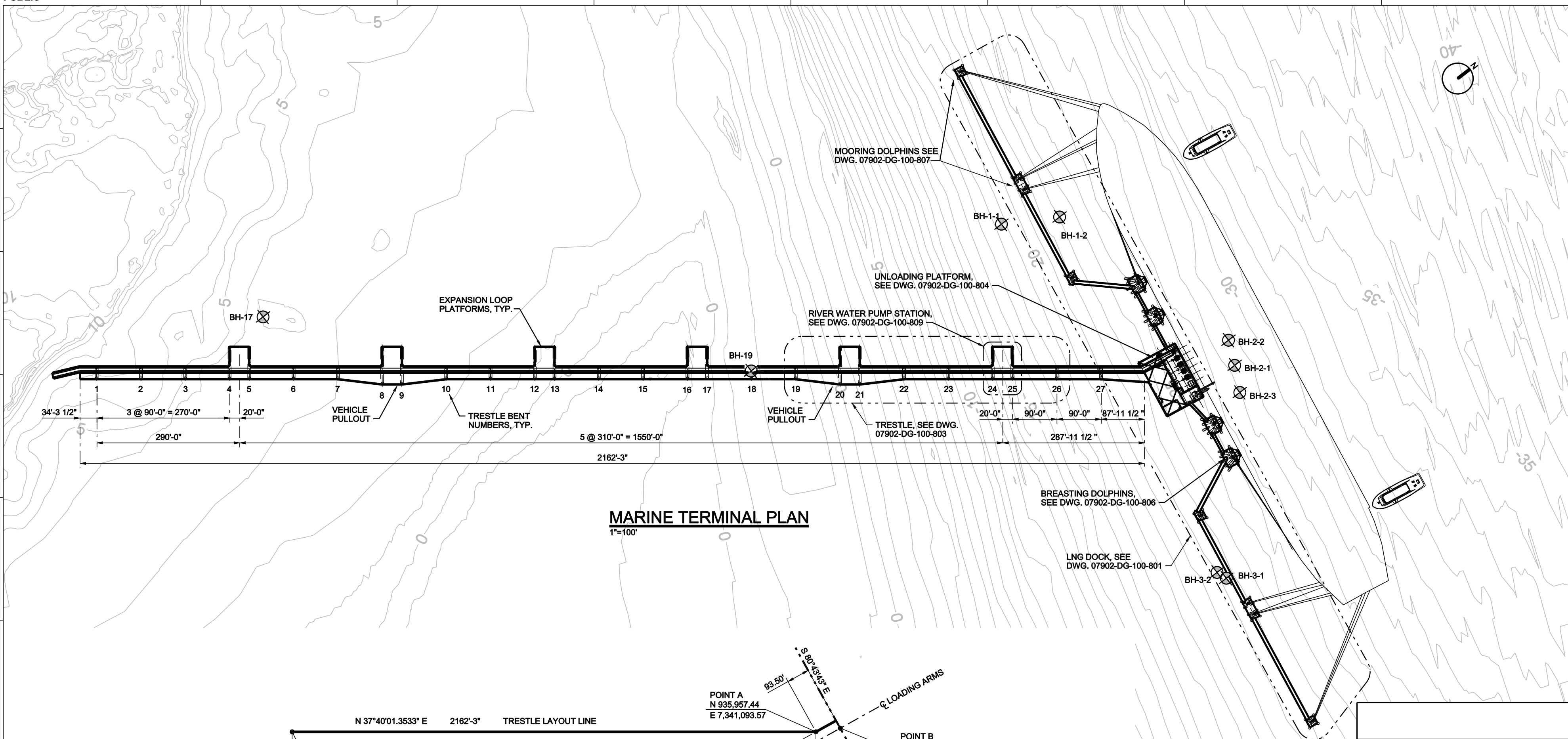
Oregon LNG

8/15/2014
Peter Hansen — Date
Chief Executive Officer

APPENDIX D

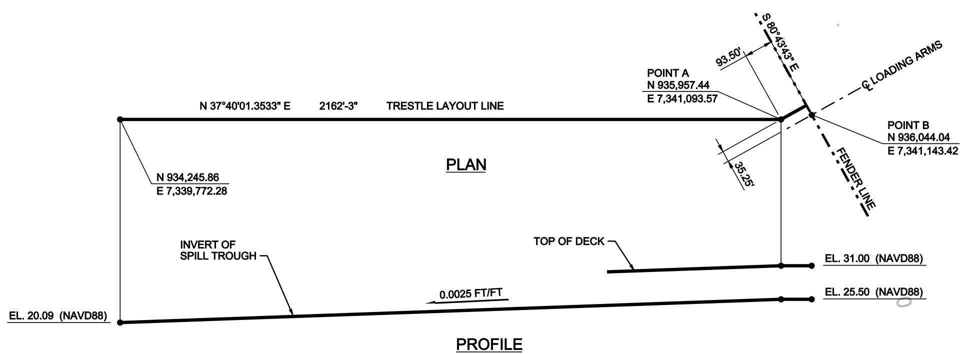
TERMINAL DIAGRAMS

PUBLIC



MARINE TERMINAL PLAN

1"=100'



MARINE TERMINAL GEOMETRY

NTS

Project Title:
OREGON LNG, LLC
NE KING AVE, WARRENTON, OR 97146

Drawing Title:
MARINE TERMINAL PLOT PLAN
Figure 1

Drawn By:	Scale:	Date:
GTM	1"=100'	5-31-12

Drawing No:	Sheet:
07902-DG-100-800	SHEET 1 OF 1

REVISIONS

Rev.	Description	Drawn & Date	Checked & Date	Approved & Date
A	ISSUED FOR CLIENT REVIEW	JLP 5/25/12		MWD 5/31/12

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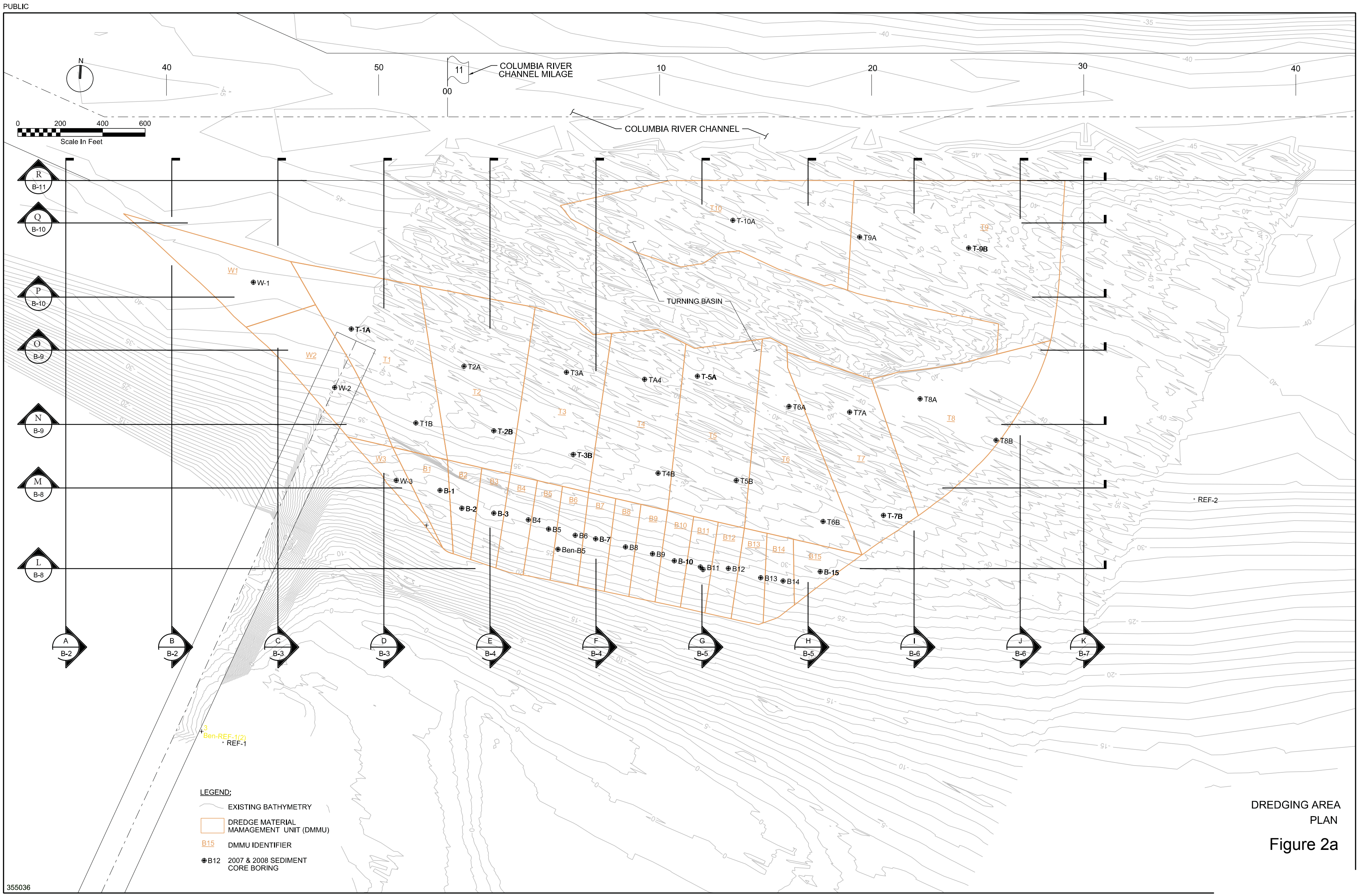
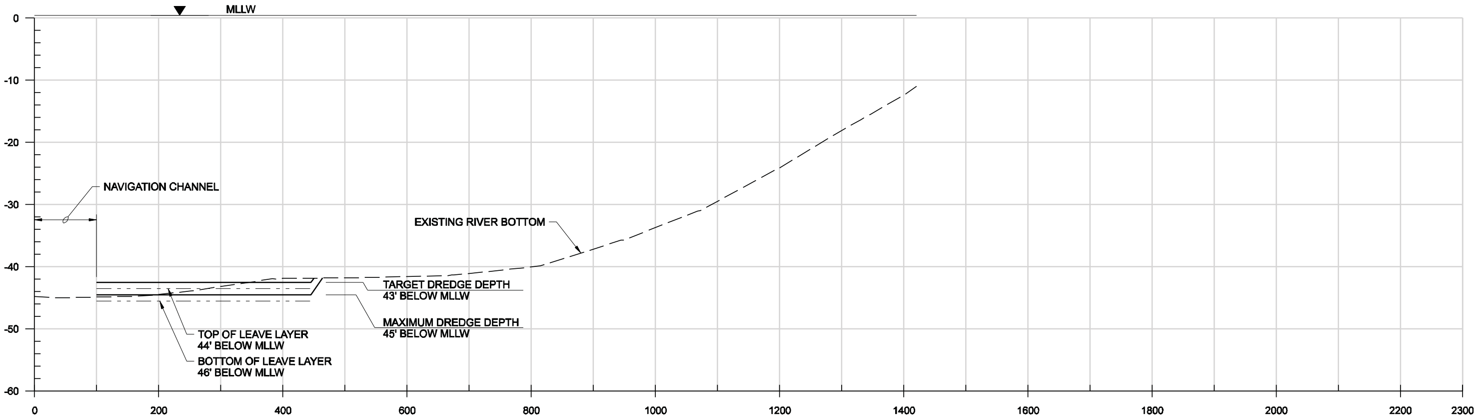


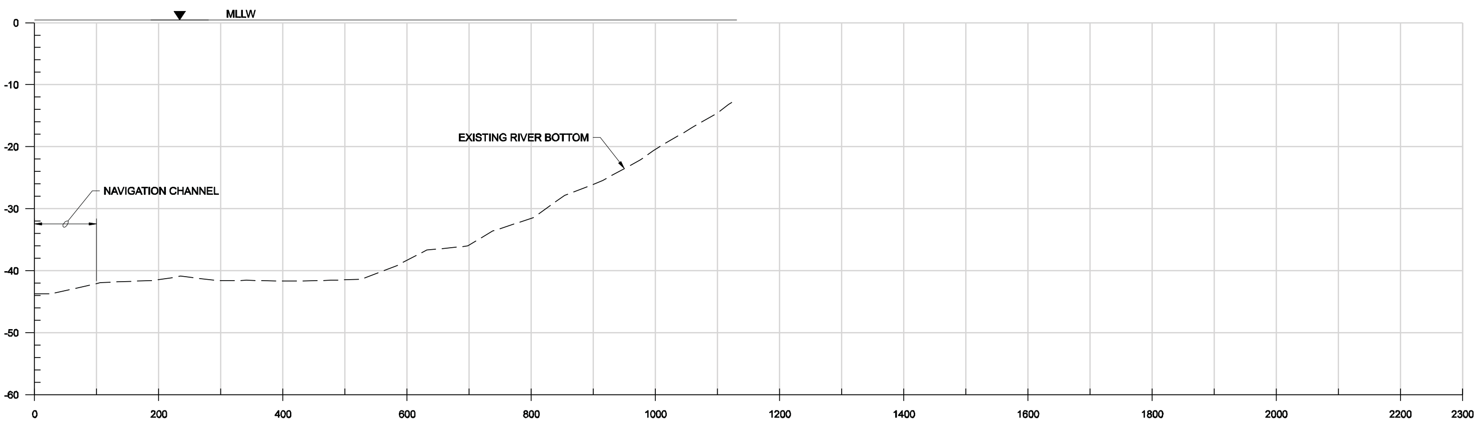
DREDGING AREA PLAN

Figure 2a

PUBLIC



B
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT



A
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

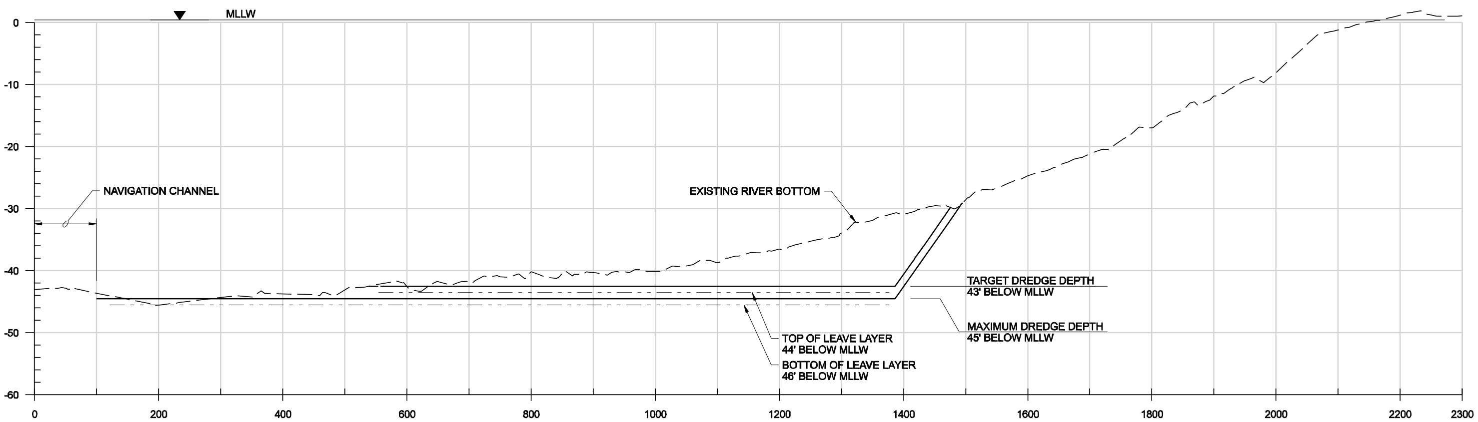
PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTIONS A & B

Figure 2b

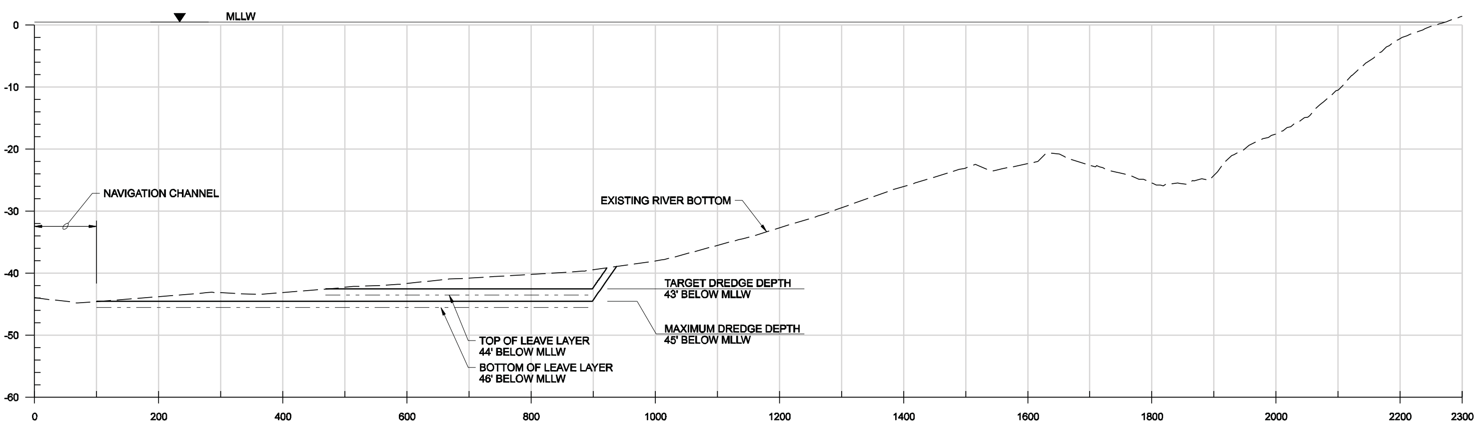
355036

DMMU_Sections2_355036.dgn 4/30/2008 4/30/2008 2:36:43 PM

PUBLIC



D
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

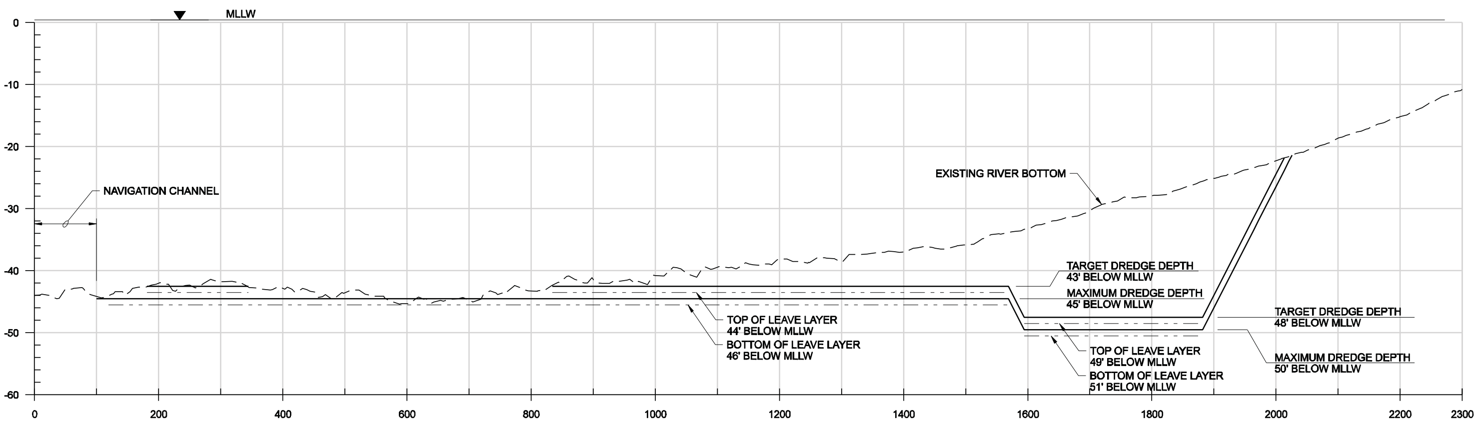


C
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

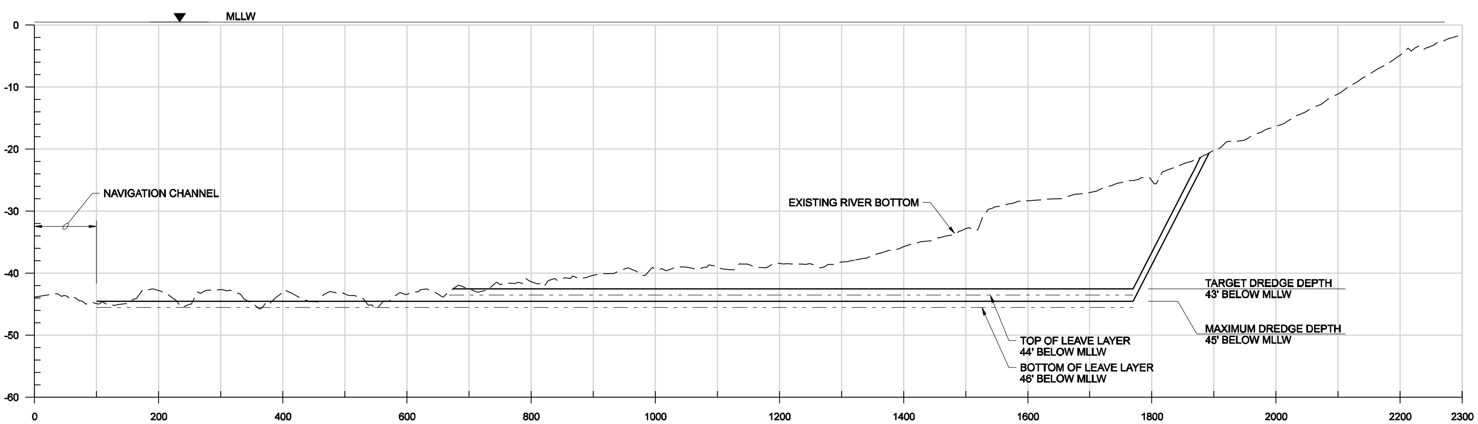
PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTIONS C & D

Figure 2c

PUBLIC



F
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT



E
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTIONS E & F

Figure 2d

355036

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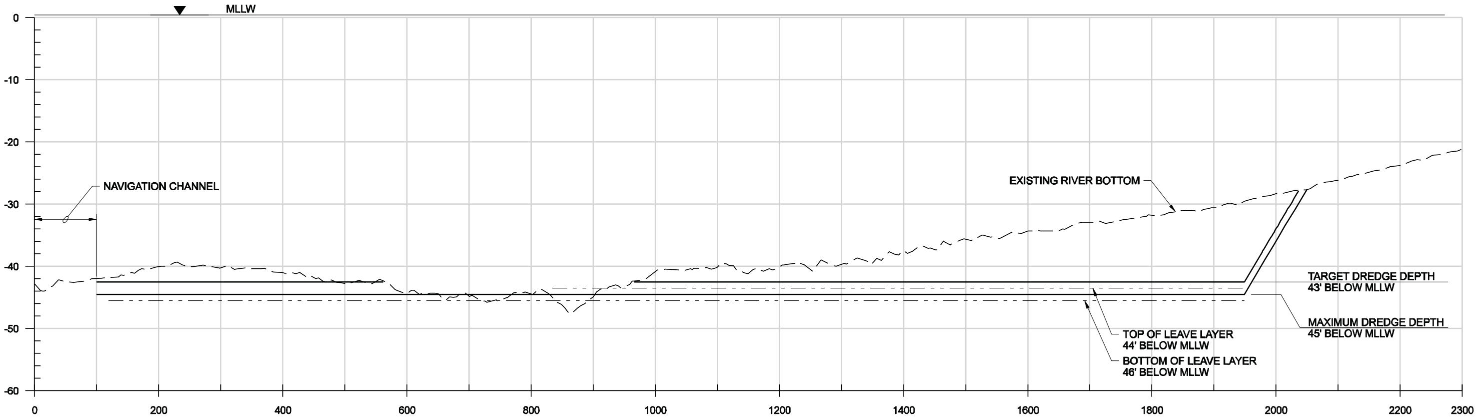
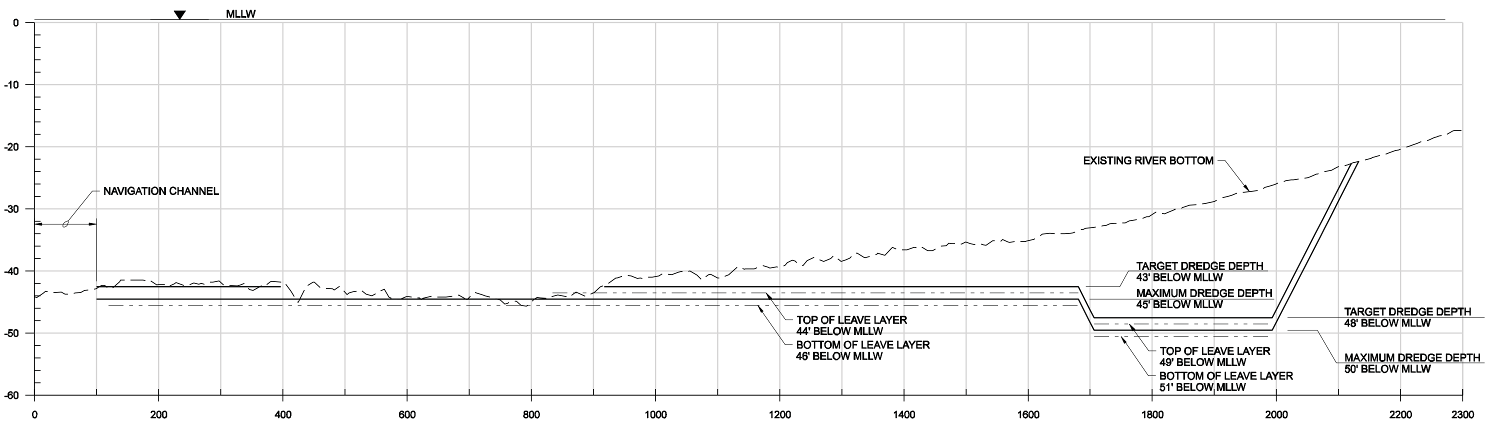


H
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT



G
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

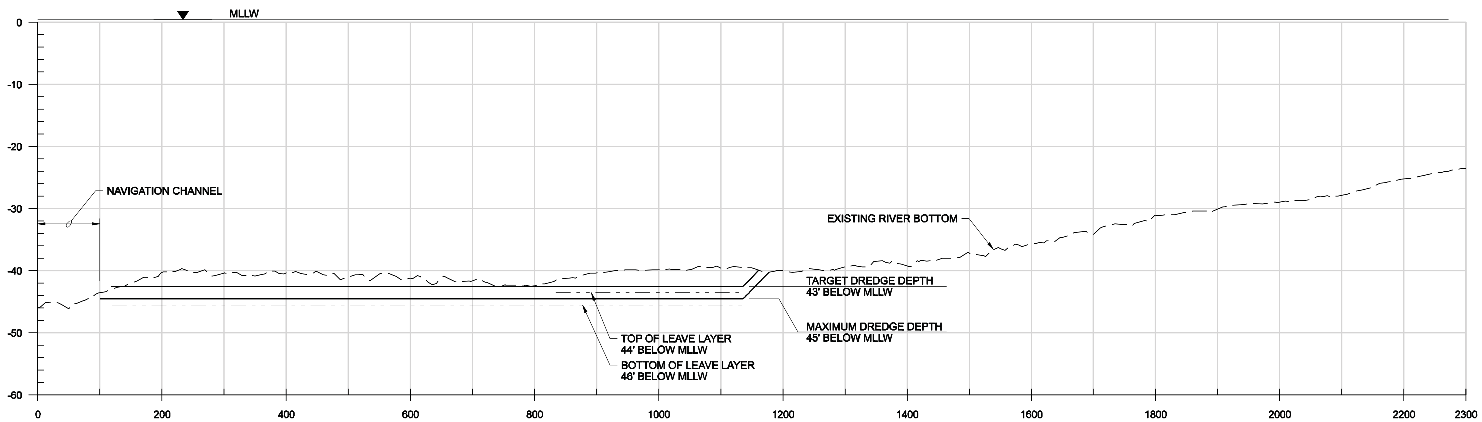
PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTIONS G & H

Figure 2e

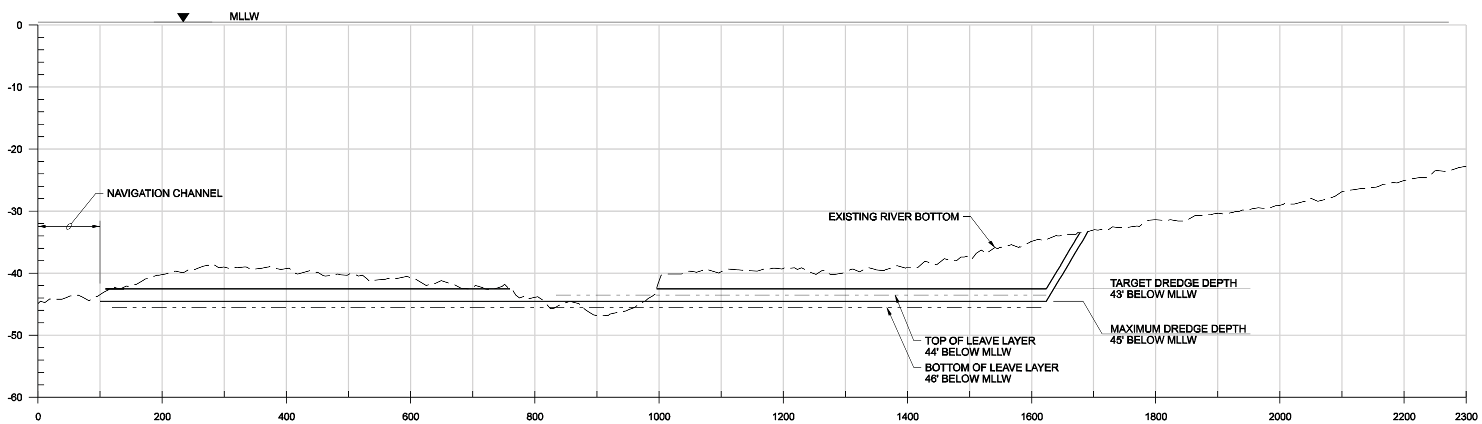
355036

DMMU_Sections2_355036.dgn 4/30/2008 4/30/20086:43 PM2:16:43 PM

PUBLIC



J
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT



I
B-1
TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTIONS I & J

Figure 2f

355036

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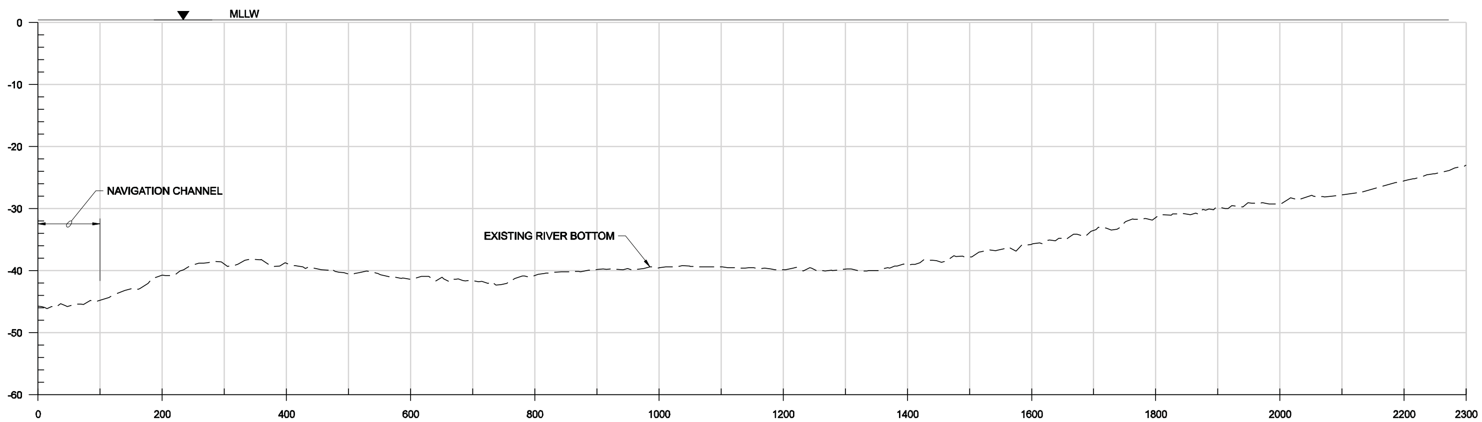


L
B-1

TURNING BASIN SECTION
1"=100' HORIZ
1"=10' VERT

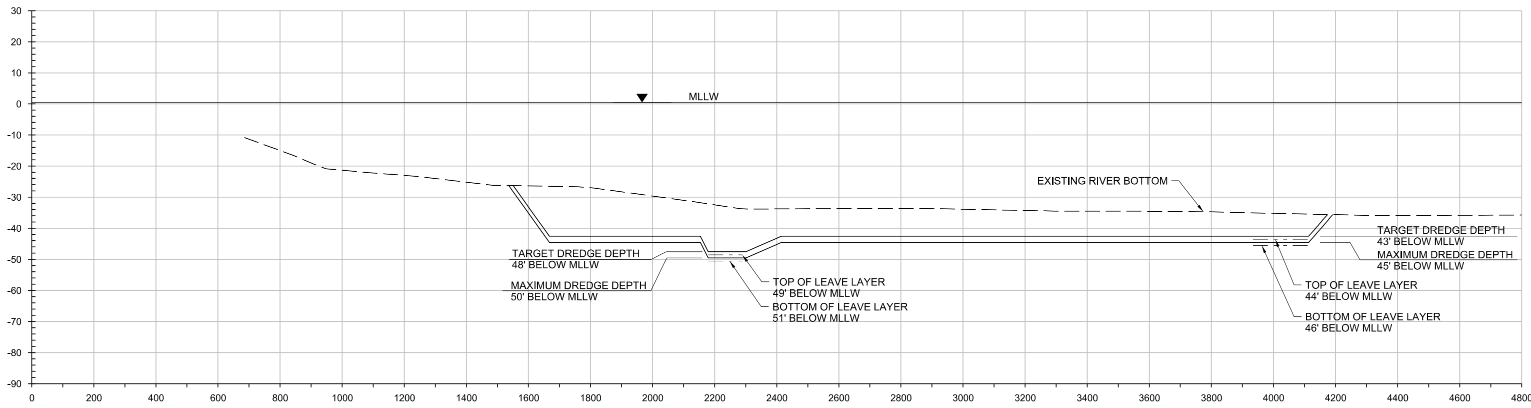
PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTION K

Figure 2g

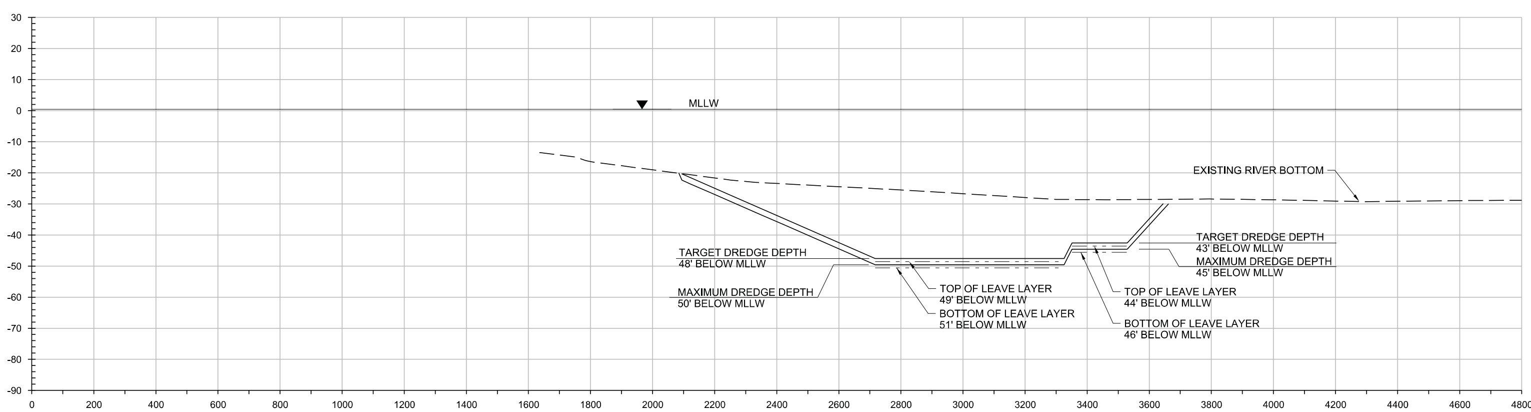
DMMU_Sections2_355036.dgn 4/30/2008 4/30/2008 2:09:16 PM

355036

PUBLIC



M
B-1
BERTH SECTION
1"=200' HORIZ
1"=20' VERT



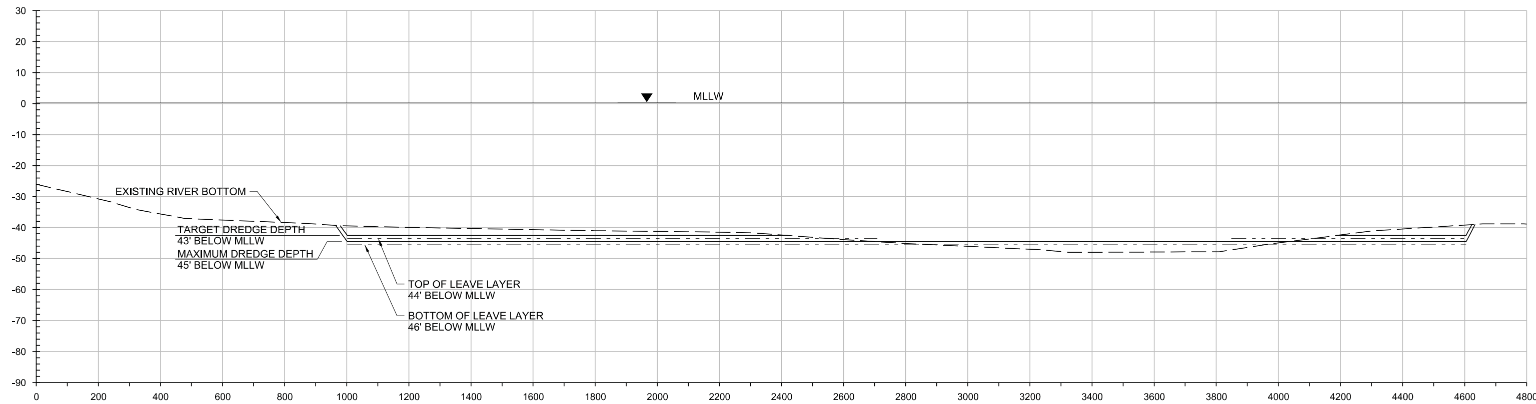
L
B-1
BERTH SECTION
1"=200' HORIZ
1"=20' VERT

PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTION L AND M

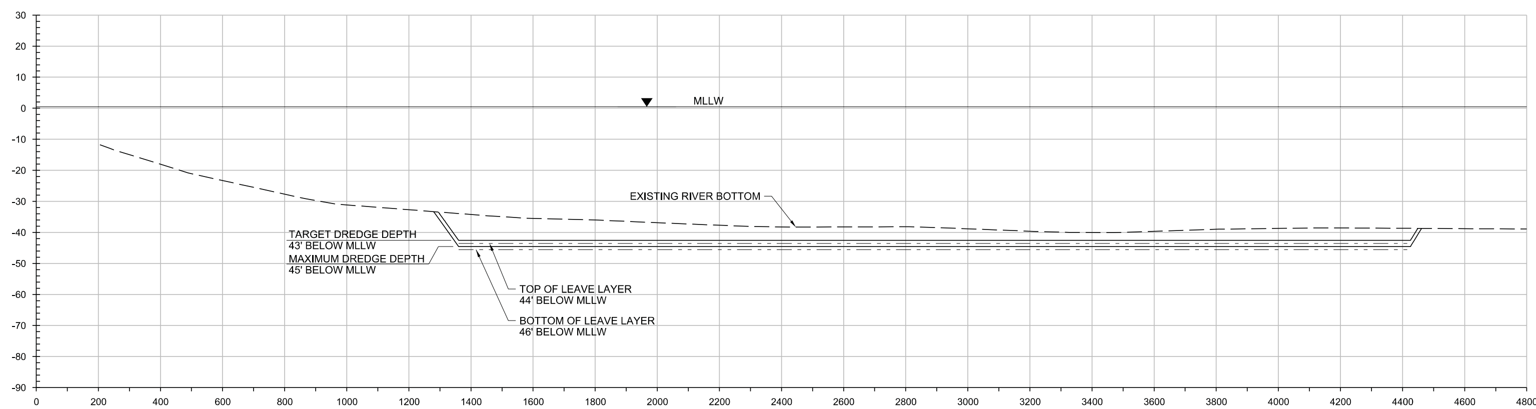
Figure 2h

355036

DMMU_Sections2_355036.dgn 4/23/2015 4/23/2016 10:50:54 AM



O
B-1
TURNING BASIN SECTION
1"=200' HORIZ
1"=20' VERT

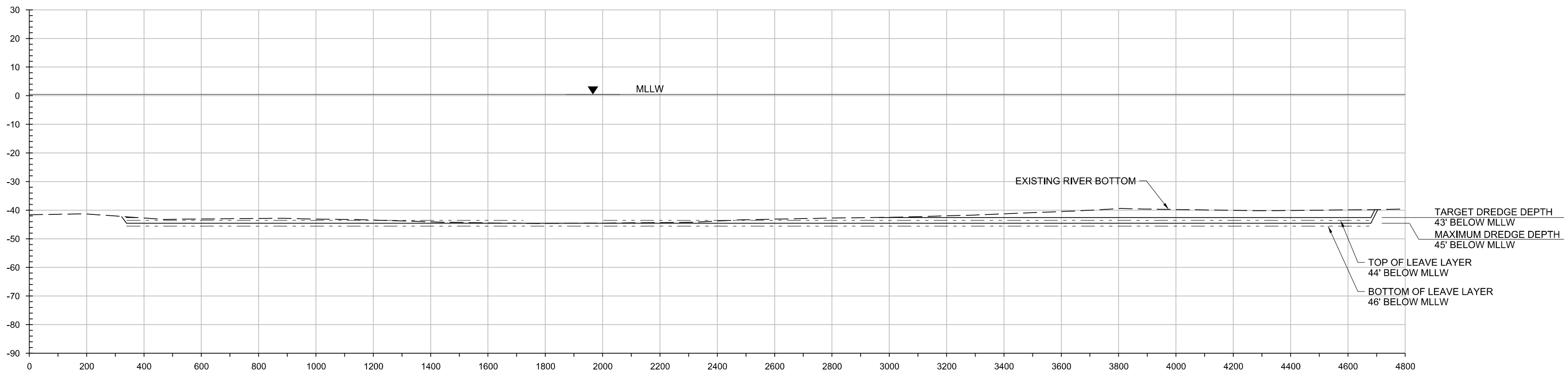


N
B-1
TURNING BASIN SECTION
1"=200' HORIZ
1"=20' VERT

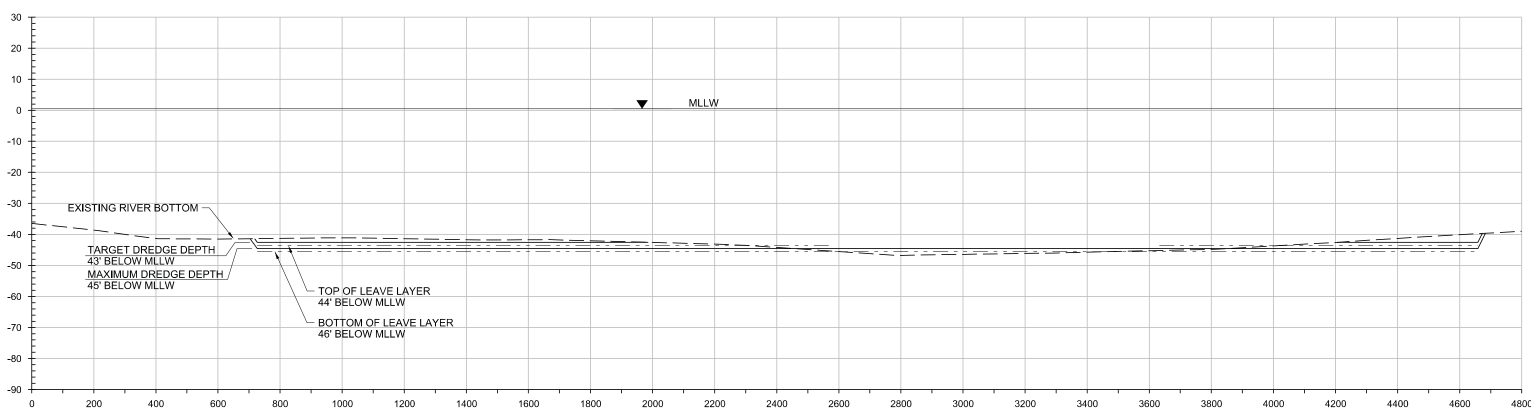
PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTION N AND O

Figure 2i

PUBLIC



Q B-1 TURNING BASIN SECTION
1"=200' HORIZ
1"=20' VERT



P B-1 TURNING BASIN SECTION
1"=200' HORIZ
1"=20' VERT

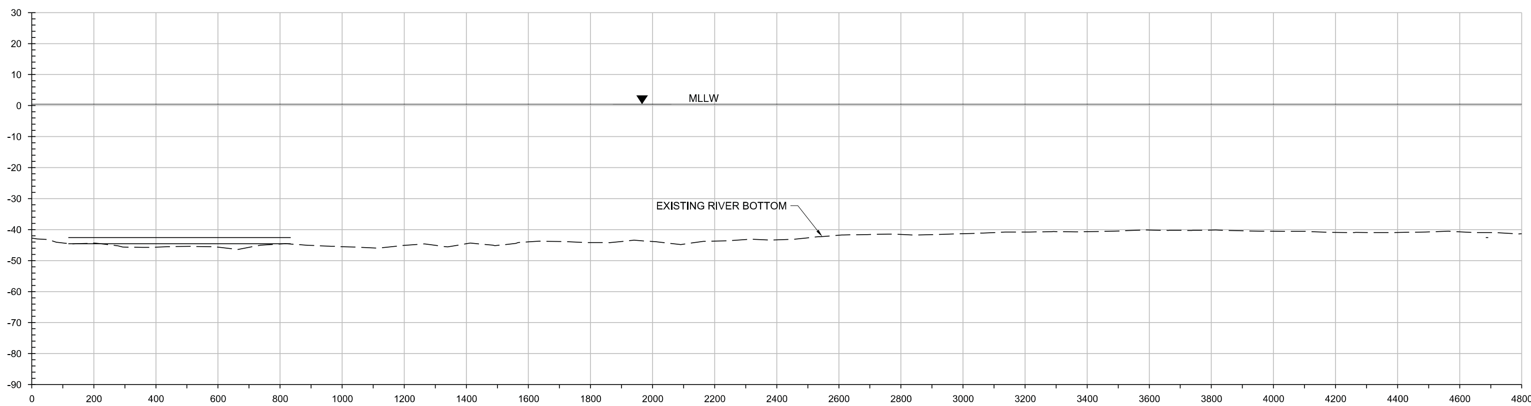
PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTION P AND Q

Figure 2j

DMMU_Sections2_355036.dgn 4/23/2015 4/23/2016:48:02 AM0:48:02 AM

355036

PUBLIC



R
B-1
TURNING BASIN SECTION
1"=200' HORIZ
1"=20' VERT

PROPOSED CROSS SECTIONS
AT DREDGING AREA
SECTION R

Figure 2k

355036

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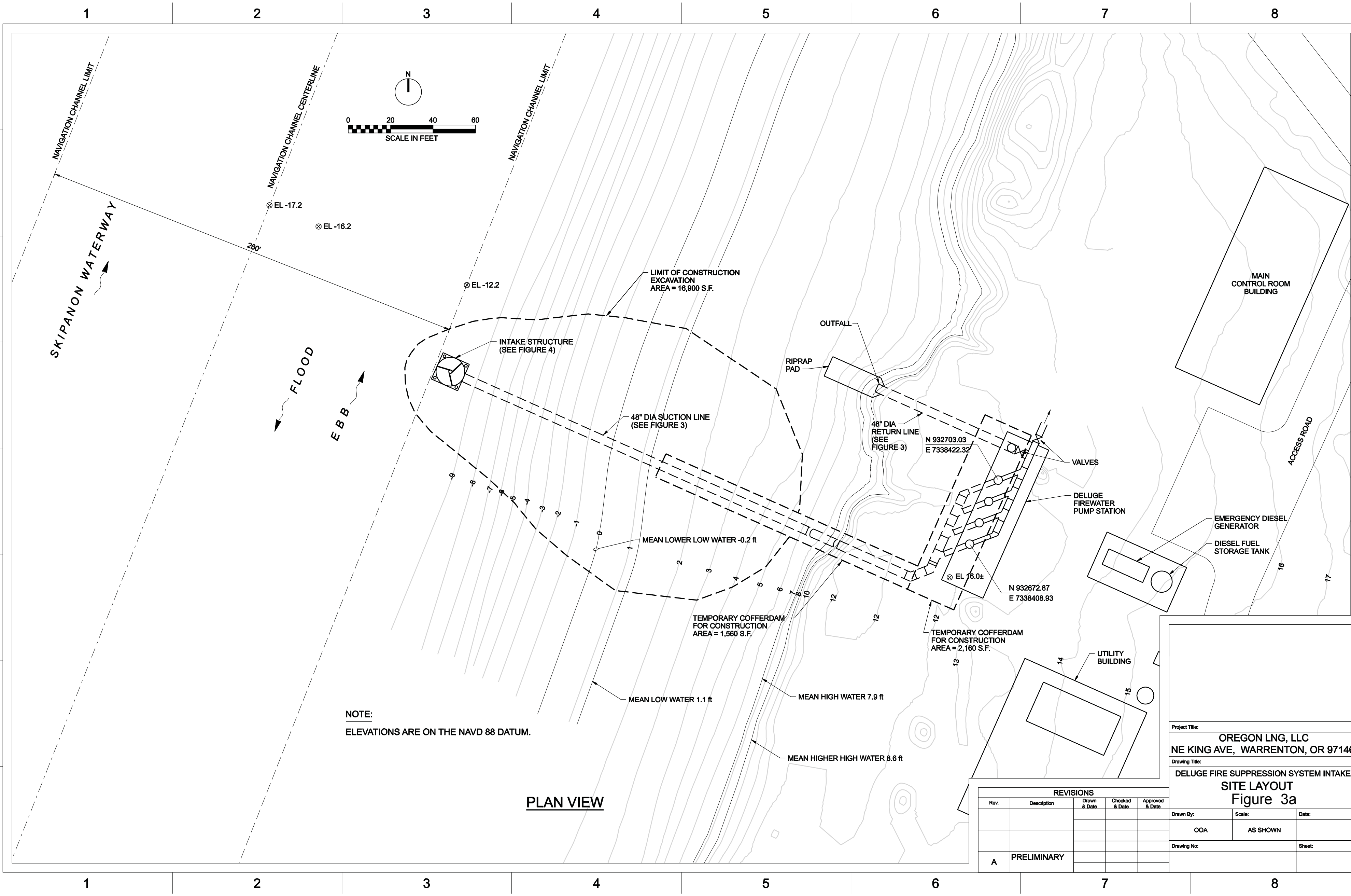

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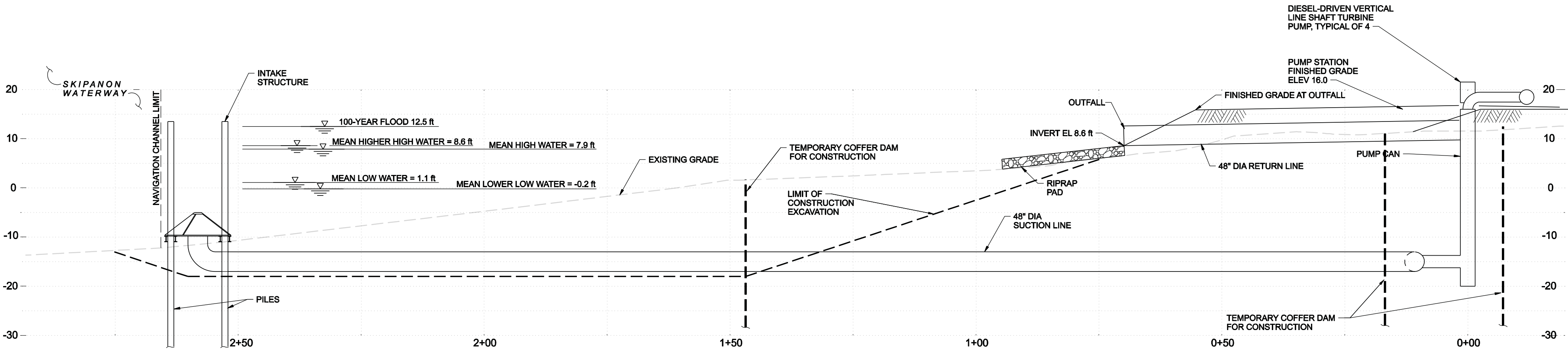
4/30/2009

EX-Fig B-2_355036.dgn



PROFILE

NOTES:

1. ELEVATIONS ARE ON THE NAVD 88 DATUM.

REVISIONS				
Rev.	Description	Drawn & Date	Checked & Date	Approved & Date
A	PRELIMINARY			

Project Title:

OREGON LNG, LLC
NE KING AVE, WARRENTON, OR 97146

Drawing Title:

DELUGE FIRE SUPPRESSION SYSTEM INTAKE
PROFILE
Figure 3b

Drawn By:	Scale:	Date:
OOA	AS SHOWN	
Drawing No:		Sheet:

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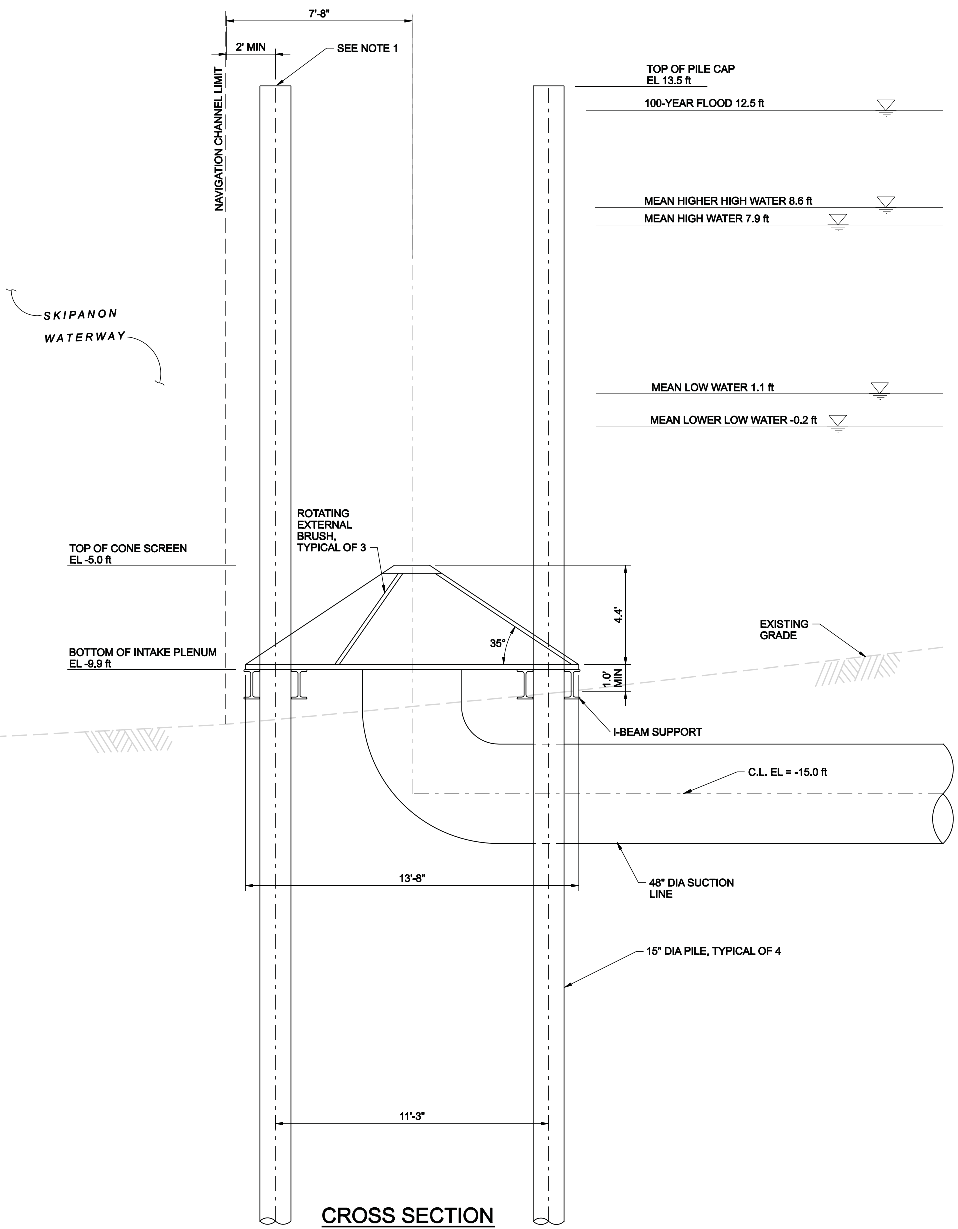
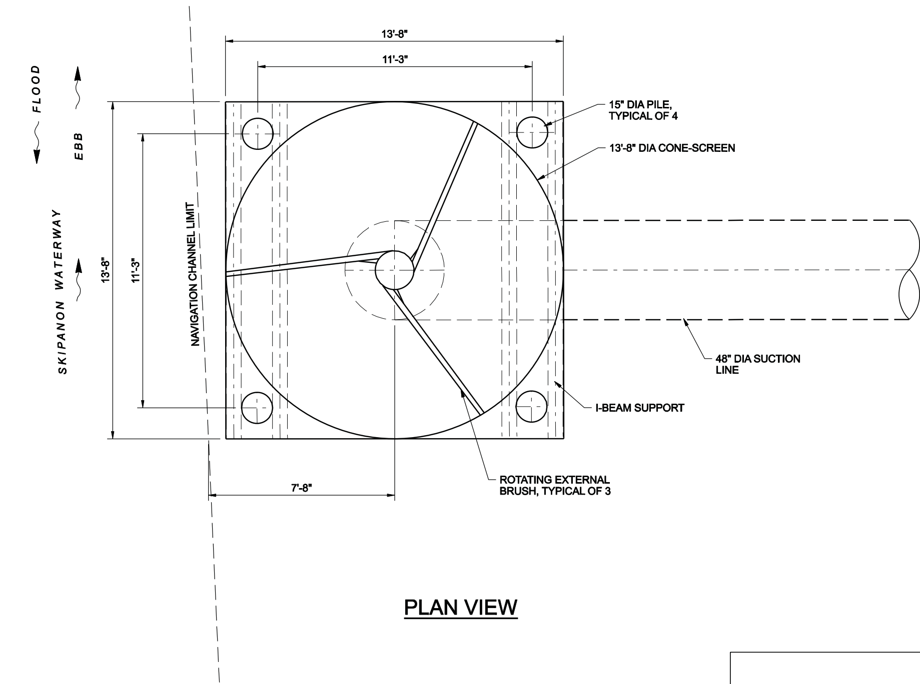


CROSS SECTION



PLAN VIEW

NOTES:

1. INSTALL NAVIGATION SIGN TO SIGNAL THE PRESENCE OF THE INTAKE.
2. ELEVATIONS ARE ON THE NAVD 88 DATUM.

0 2.5 5 7.5
SCALE IN FEET

REVISIONS				
Rev.	Description	Drawn & Date	Checked & Date	Approved & Date
A	PRELIMINARY			

Project Title:
OREGON LNG, LLC
NE KING AVE, WARRENTON, OR 97146

Drawing Title:
DELUGE FIRE SUPPRESSION SYSTEM INTAKE
PLAN AND SECTION
Figure 3c

Drawn By:	Scale:	Date:
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Drawing No:		Sheet:

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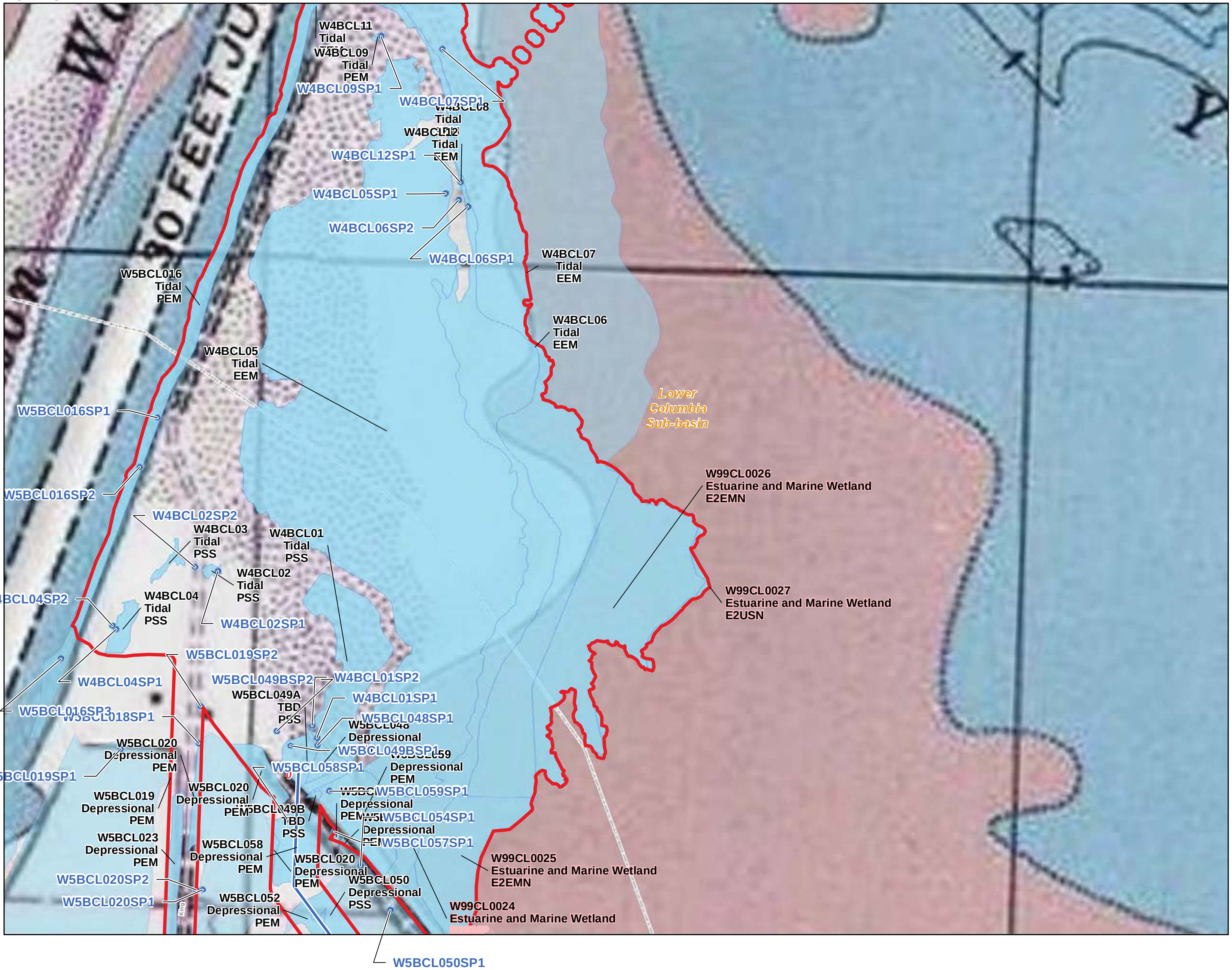


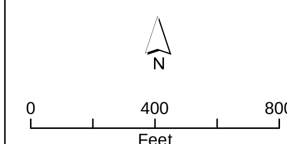
Figure 4a

Wetland Delineation Map, Water and Wastewater Pipelines

LEGEND

- Pipeline Route
- Pipeline Route Milepost (Qtr Mile)
- New Access Road
- Wetland Study Area
- County Boundary
- Wetland Sample Point
- Stream
- Wetland

Note: Proxy data highlighted in pink



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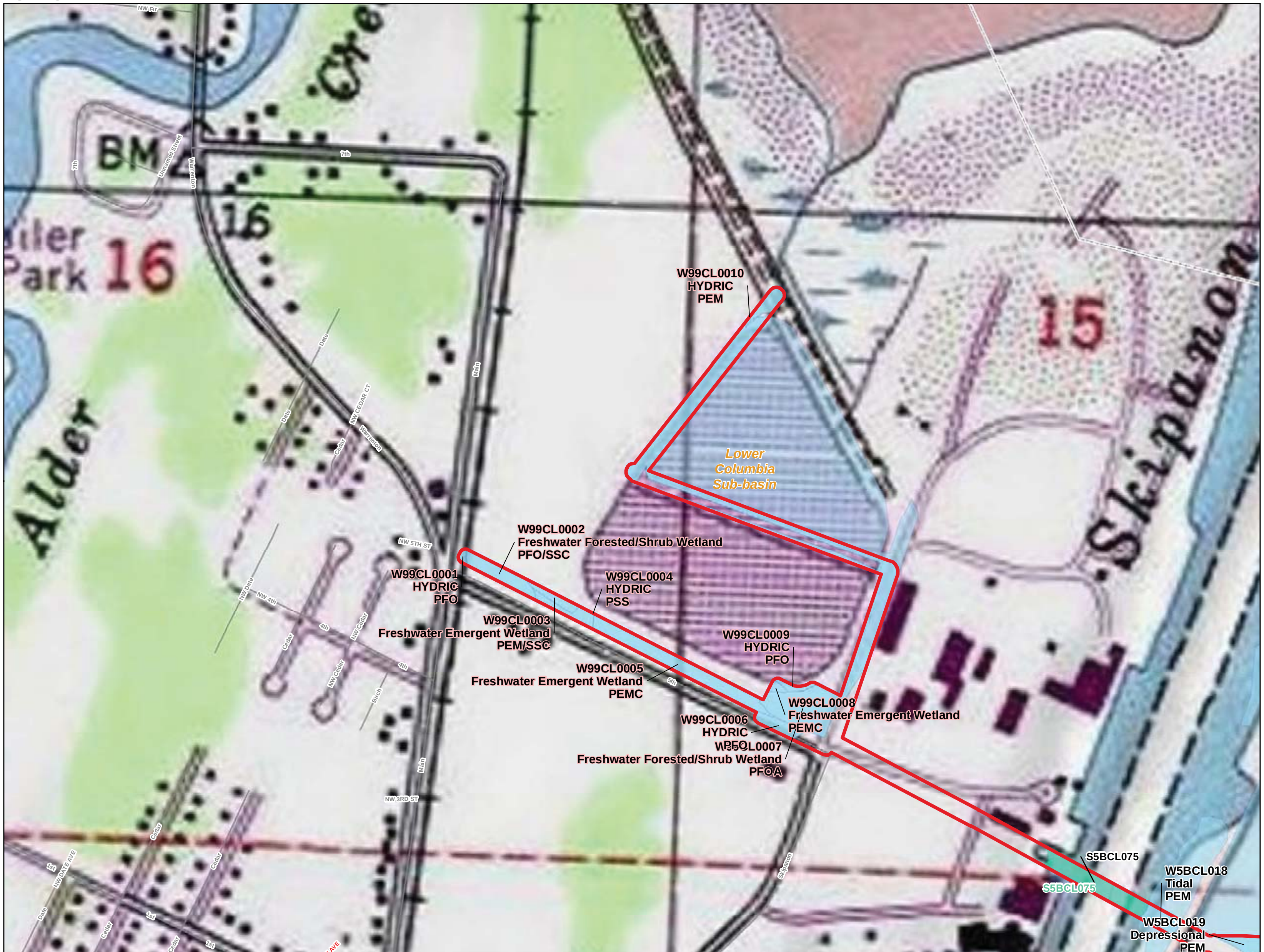


Figure 4b
Wetland Delineation Map,
Water and Wastewater Pipelines

LEGEND

- Pipeline Route
- Pipeline Route Milepost (Qtr Mile)
- New Access Road
- Wetland Study Area
- County Boundary
- Wetland Sample Point
- Stream
- Wetland

Note: Proxy data highlighted in pink

N

0 400 800
Feet

PUBLIC

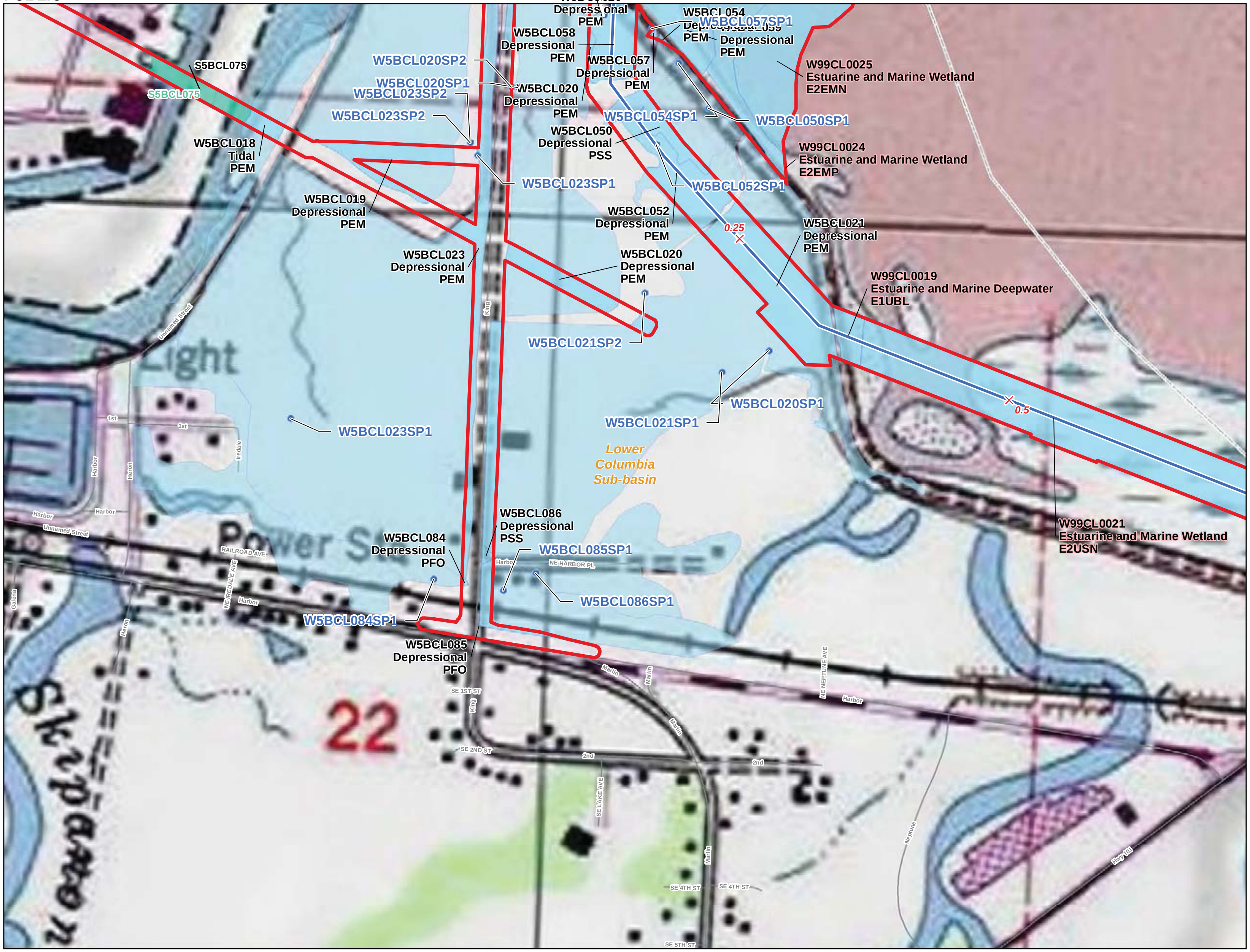


Figure 4c

Wetland Delineation Map, Water and Wastewater Pipelines

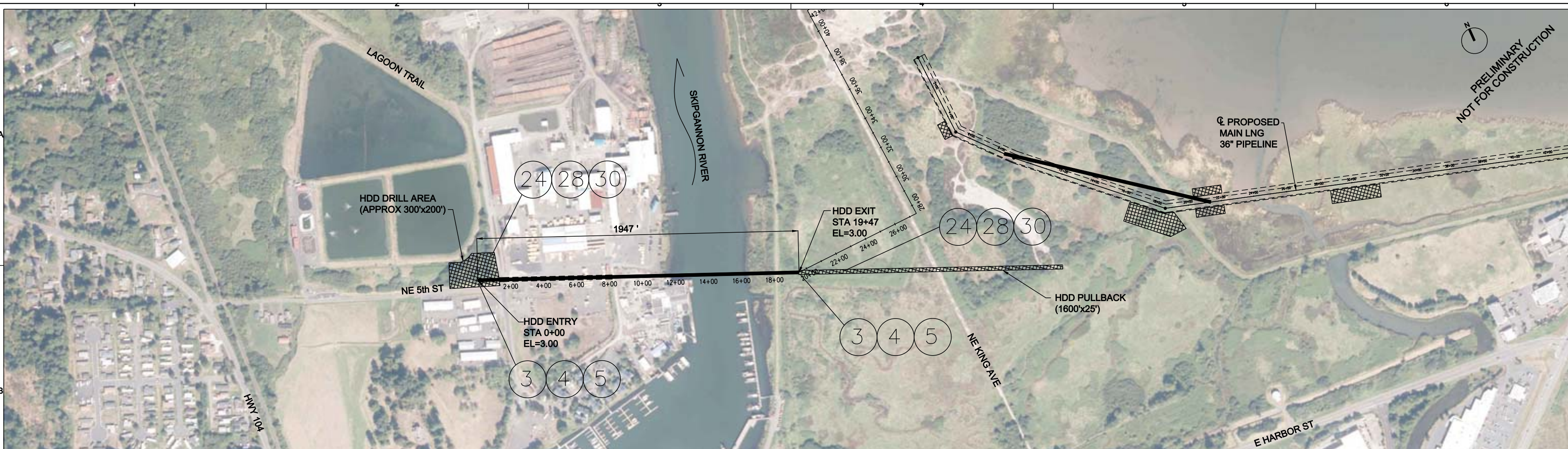
LEGEND

- Pipeline Route
- Pipeline Route Milepost (Qtr Mile)
- New Access Road
- Wetland Study Area
- County Boundary
- Wetland Sample Point
- Stream
- Wetland

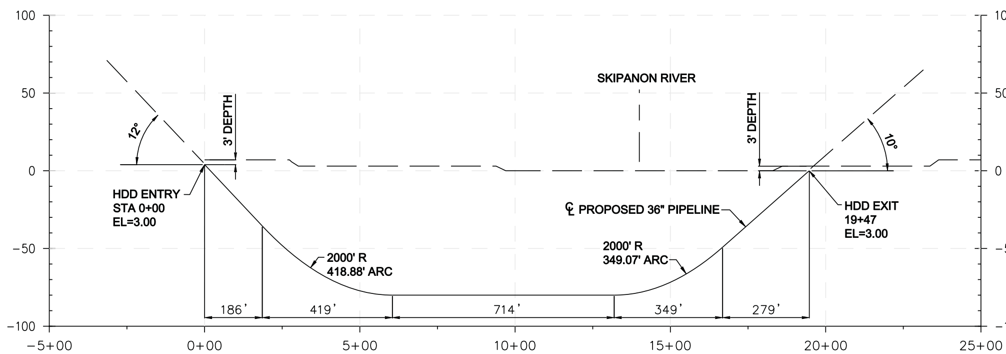
Note: Proxy data highlighted in pink

N

0 400 800
Feet



STREAM ID	S5BCL075
BANK FULL WIDTH (FT)	85
BANK FULL DEPTH (FT)	30
GRADIENT (%)	0.0
VERTICAL SCOUR POTENTIAL	None
LATERAL CHANNEL MIGRATION POTENTIAL	Slight
ROSGEN CHANNEL TYPE	C6
BEDROCK (%)	No Data
BOULDER (%)	No Data
COBBLE (%)	No Data
RUBBLE (%)	No Data
GRAVEL (%)	No Data
FINES (%)	No Data



PROFILE

HORIZ: 1"=200'
VERT: 1"=50'

Figure 5

NO.	DATE	REVISION	BY	APVD
DSGN T.COTTEN	DR Z.BROWN	CHK M.BRICKER	APVD XXX	

MATERIAL

SCALE

1"=300'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

LEGEND

- TWS (TEMPORARY WORK SPACE)
- ATWS (ADDITIONAL TEMPORARY WORK SPACE)
- PROPOSED ALIGNMENT MILE POST
- MAIN LINE VALVE
- HDD (HORIZONTAL DIRECTIONAL DRILL) ACCESS POINT
- WETLAND BOUNDARY
- COUNTY LINE
- PERMANENT EASEMENT LINE
- ALIGNMENT PI (POINT OF INTERSECTION)
- SECTION LINE
- ROADWAY CENTERLINE
- CITY LIMIT LINE
- PROPERTY LINE
- UTILITY LINE
- OVERHEAD POWER LINE

OREGON PIPELINE COMPANY
WARRENTON TO WOODLAND
PIPELINE

LOC: CLATSOP COUNTY , OR AND COWLITZ COUNTY, WA

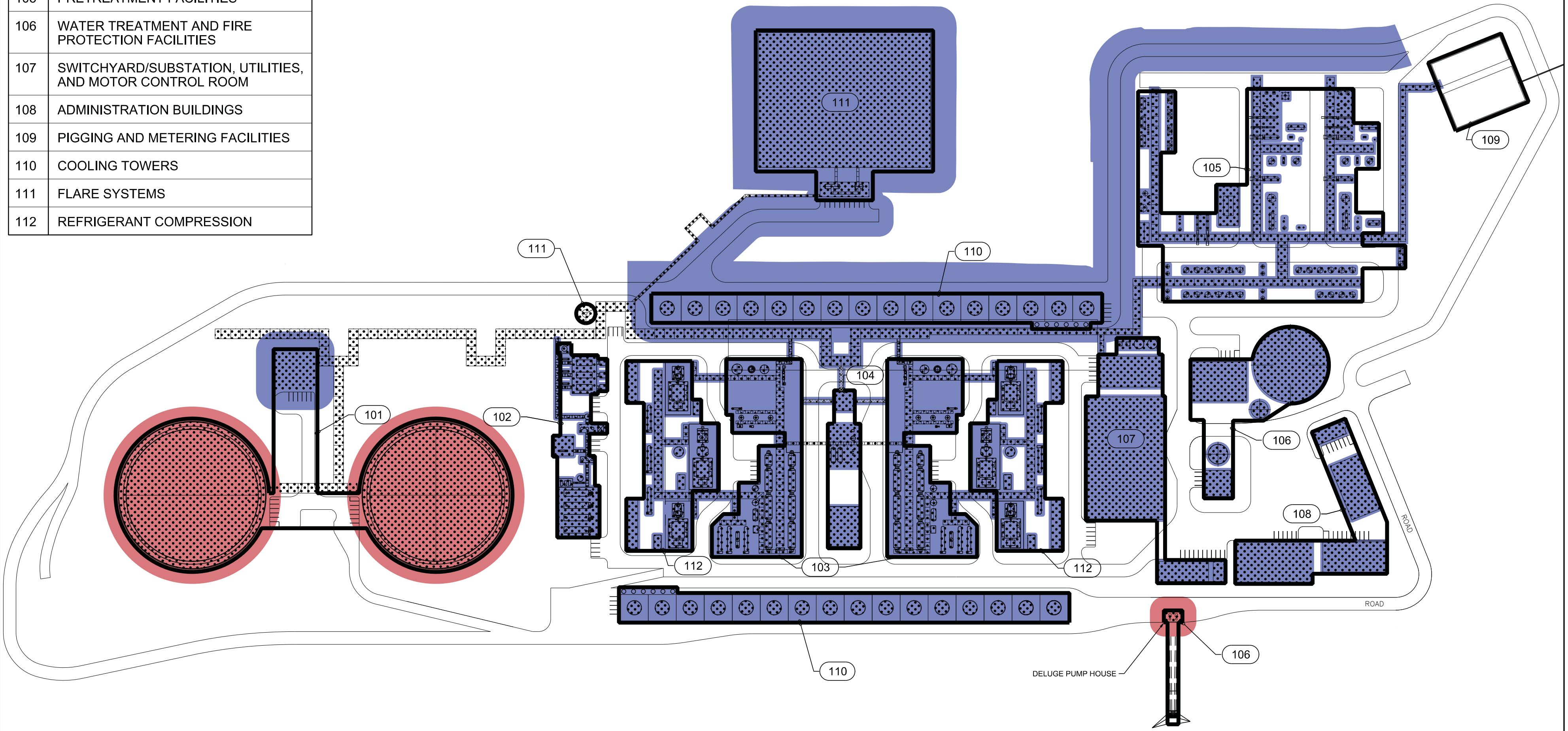
PROJ: 355036 DATE: AUGUST,2012

HDD EXHIBIT - SKIPANON RIVER FOR TERMINAL UTILITIES

from STA:	to STA:
from MP:	to MP:
DWG:	REVISION:

PUBLIC

KEY	DESCRIPTION
101	LNG STORAGE TANKS
102	REGASIFICATION FACILITIES
103	LIQUEFACTION FACILITIES
104	REFRIGERANT STORAGE
105	PRETREATMENT FACILITIES
106	WATER TREATMENT AND FIRE PROTECTION FACILITIES
107	SWITCHYARD/SUBSTATION, UTILITIES, AND MOTOR CONTROL ROOM
108	ADMINISTRATION BUILDINGS
109	PIGGING AND METERING FACILITIES
110	COOLING TOWERS
111	FLARE SYSTEMS
112	REFRIGERANT COMPRESSION



LEGEND
Stone Columns
Cement Deep Soil Mixing
Piles

0 100 200 300
Scale In Feet

Ground Improvements
and Foundations
Bidirectional Terminal

Figure 6

PUB-Fig1.5-5_Ground_Improvement.dgn 2013\05\17 8:23:25 AM

355036

Figure 7
Oregon LNG Terminal
Existing Conditions on the
East Skipanon Peninsula

LEGEND

- Ordinary High Water Elevation (9.85 feet NAVD88)
- Mean High Water Elevation (7.75 feet NAVD88)
- Tax Lot
- Wetland

N

0 300 600
Feet

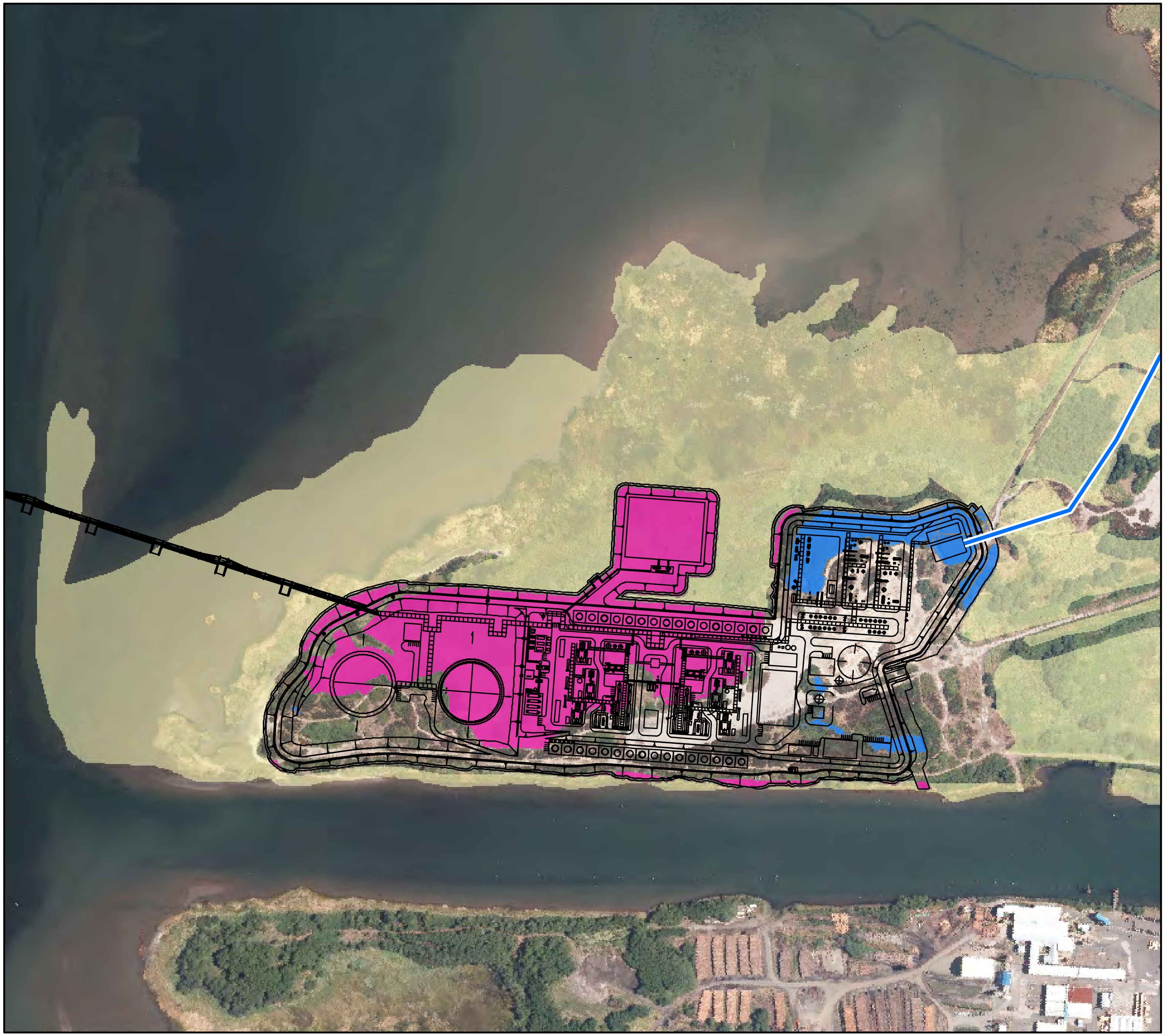


Figure 8

Figure does not show wetlands on the west bank of the Skipanon River because this area was outside the study area.

Legend

Pipeline Route

Wetland

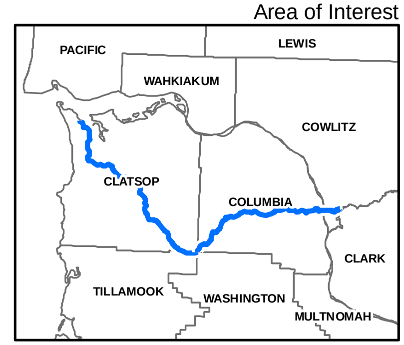
Temporary and Permanent Wetland Disturbance

Estuarine

Palustrine

Note:
Impacts encompass the permanent footprint for Terminal operation and the temporary footprint for construction. The Terminal water/wastewater lines, wastewater pump station, and access road are not included.

Area of Interest



N

0 325 650
Feet

APPENDIX E

OREGON LNG PIPELINE FACILITY MAPS AND DRAWINGS

APPENDIX E1

PIPELINE LOCATION MAPS; CONSTRUCTION STAGING/STORAGE AREAS

Figure 1
Aerial Maps of the Pipeline

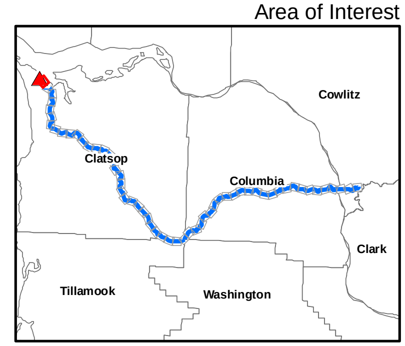
LEGEND

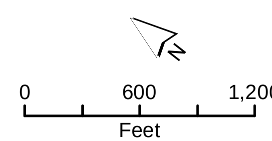
- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest





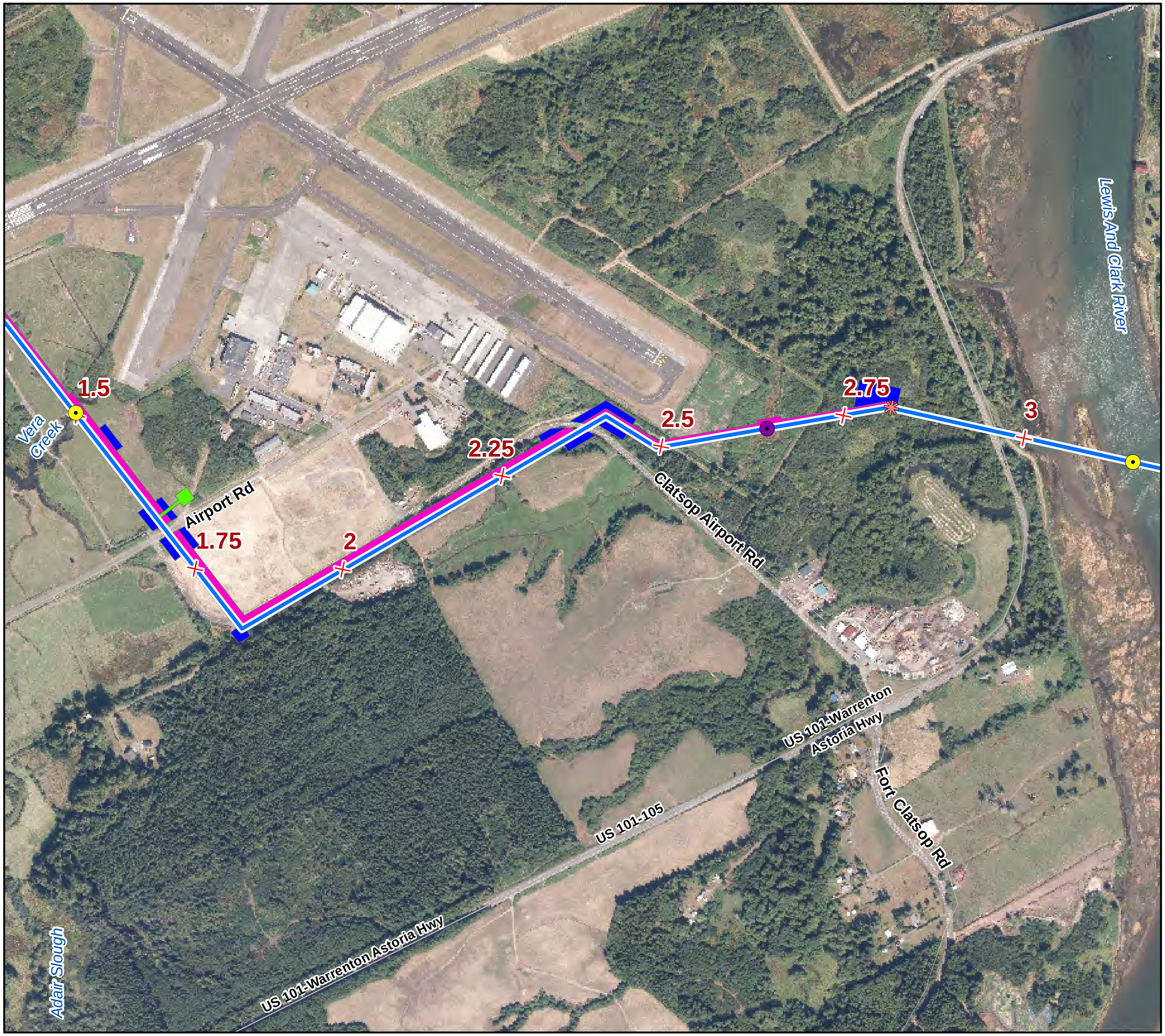


Figure 2
Aerial Maps of the Pipeline

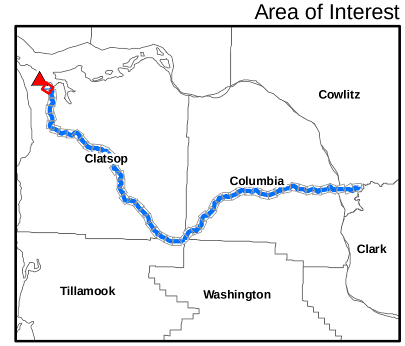
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

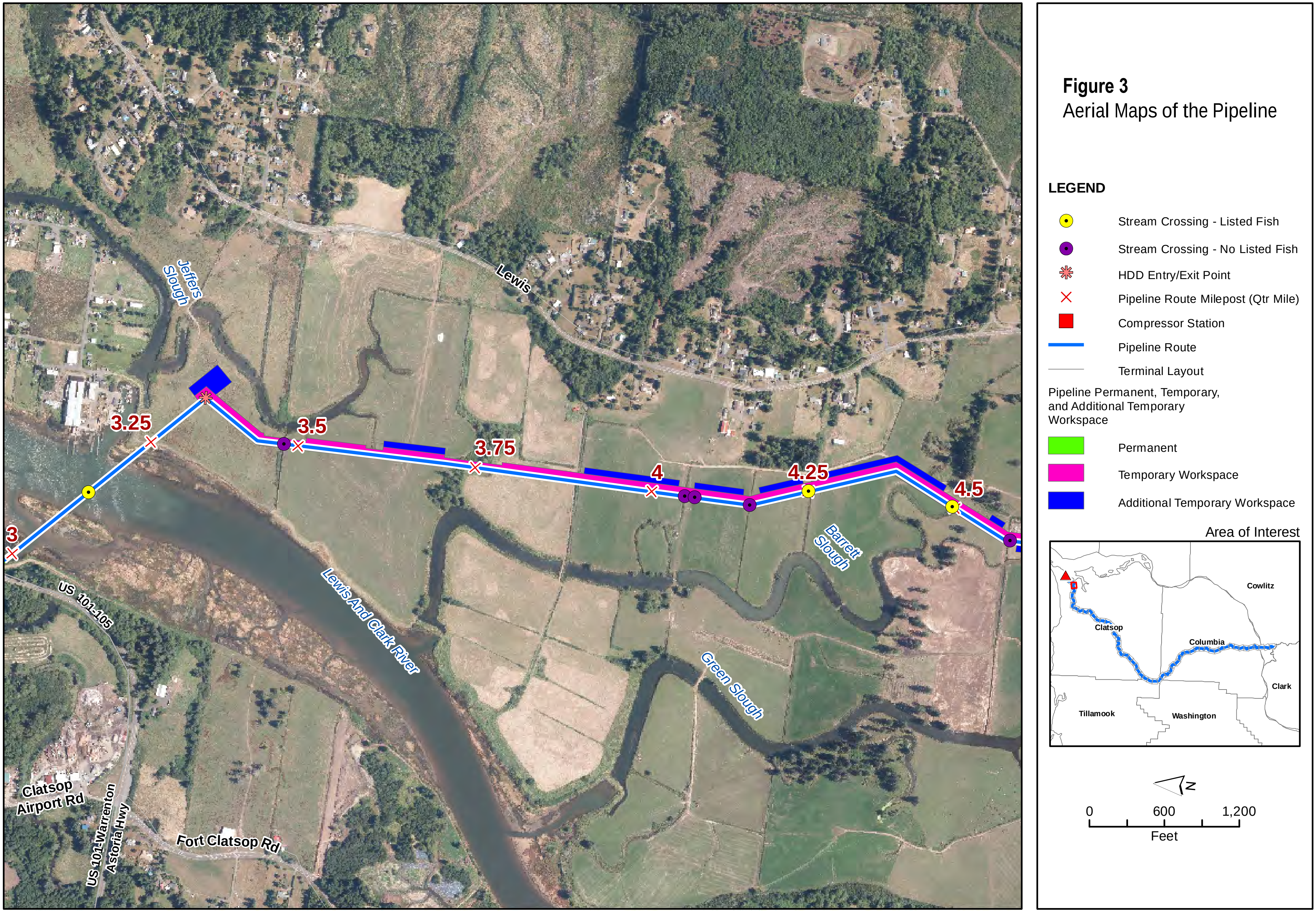
Area of Interest



N

0 600 1,200
Feet

Figure 3
Aerial Maps of the Pipeline



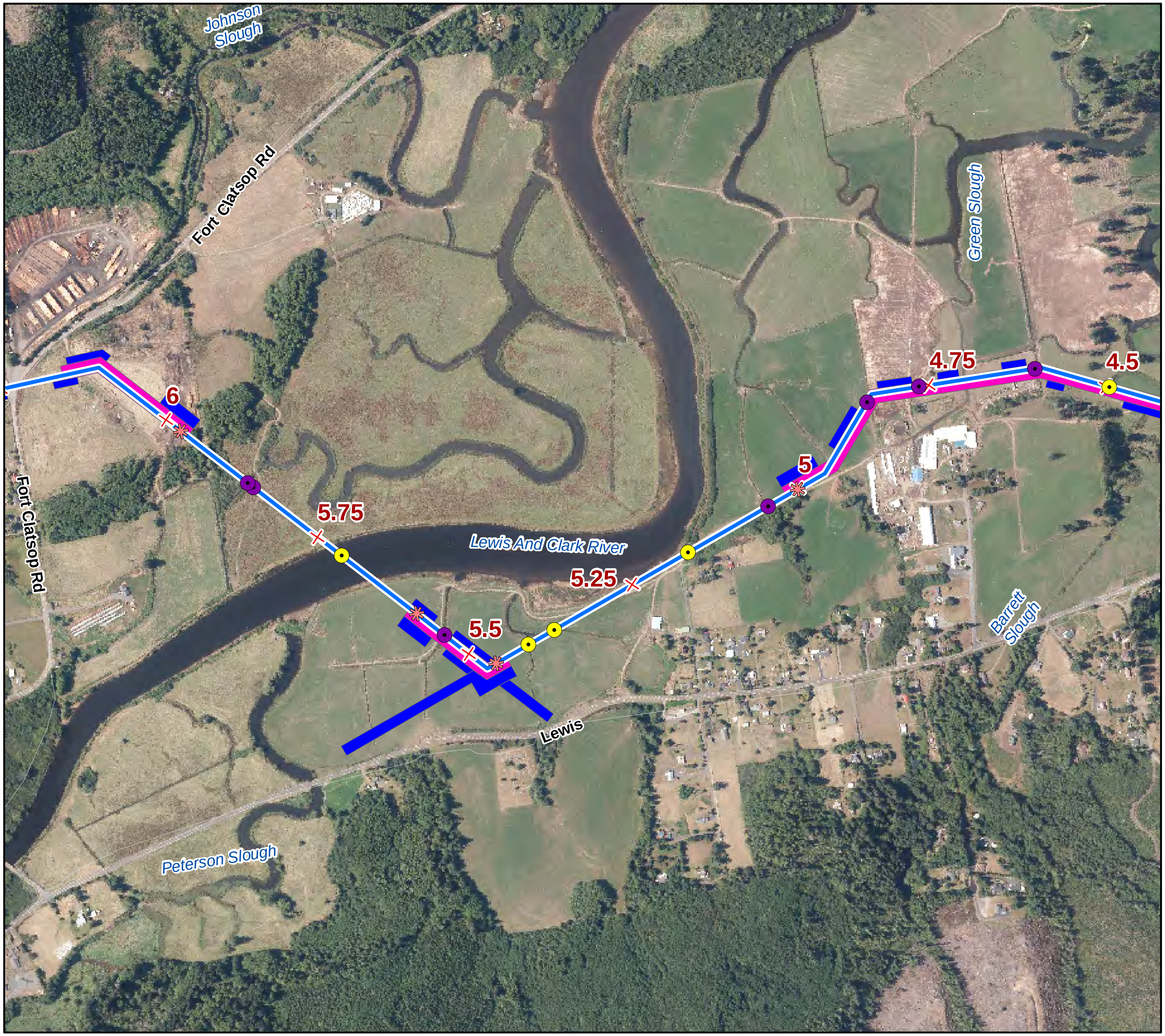


Figure 4
Aerial Maps of the Pipeline

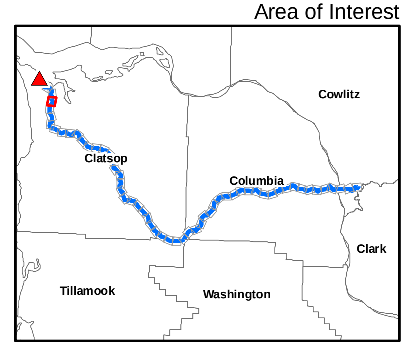
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

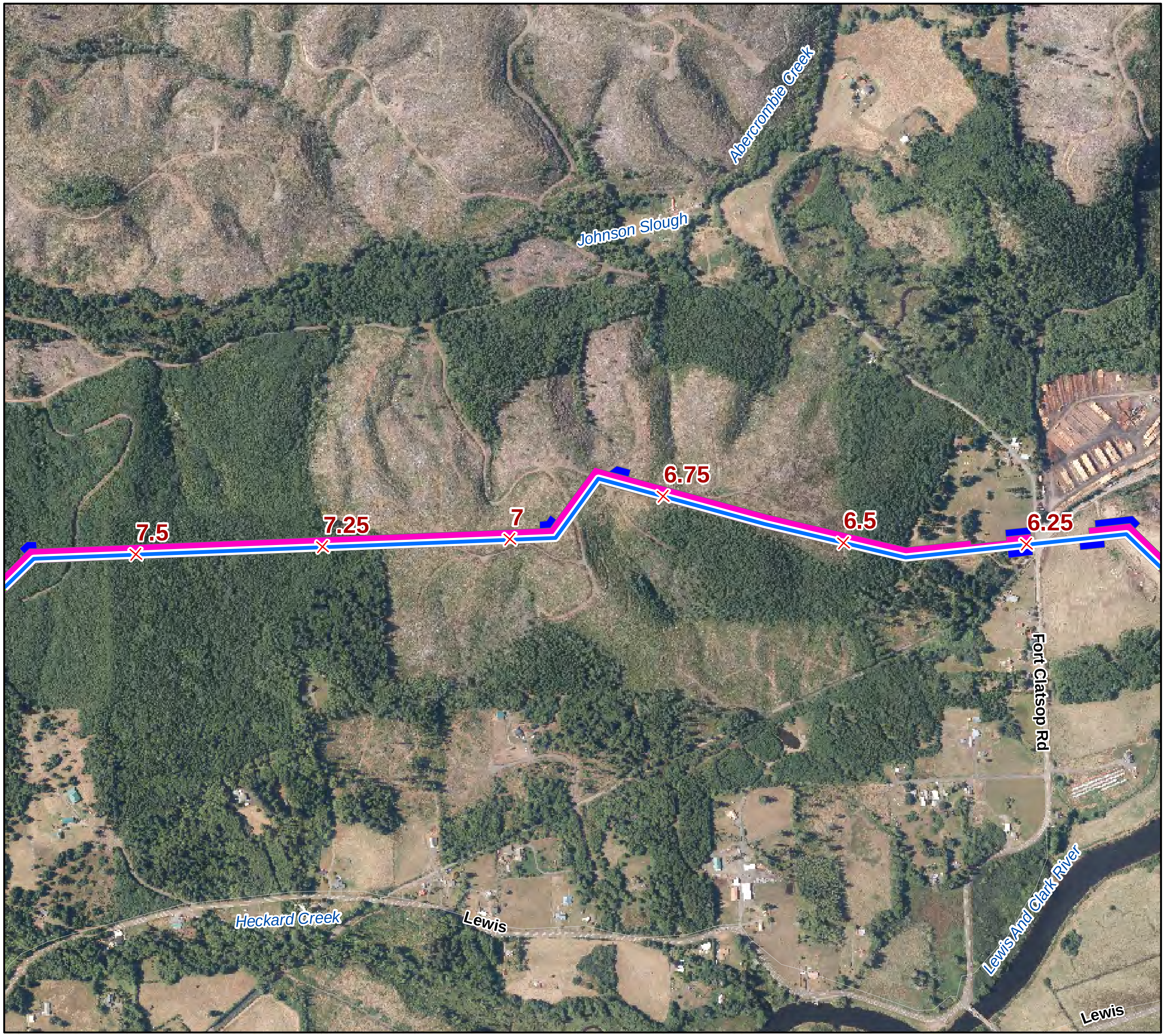


Figure 5

Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish

Stream Crossing - No Listed Fish

HDD Entry/Exit Point

Pipeline Route Milepost (Qtr Mile)

Compressor Station

Pipeline Route

Terminal Layout

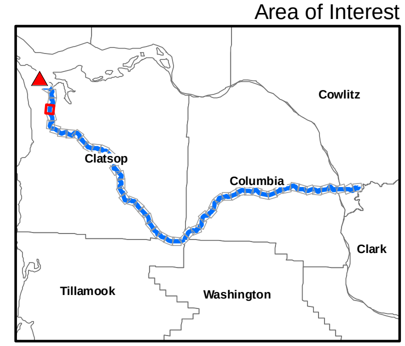
Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent

Temporary Workspace

Additional Temporary Workspace

Area of Interest



0 600 1,200

Feet

Figure 6
Aerial Maps of the Pipeline

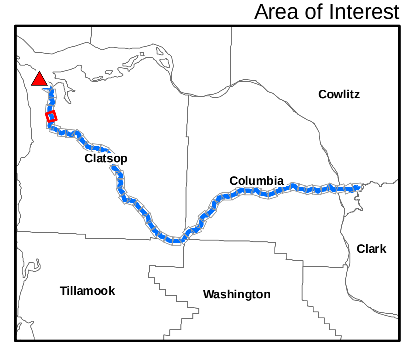
LEGEND

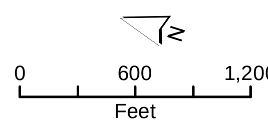
Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest





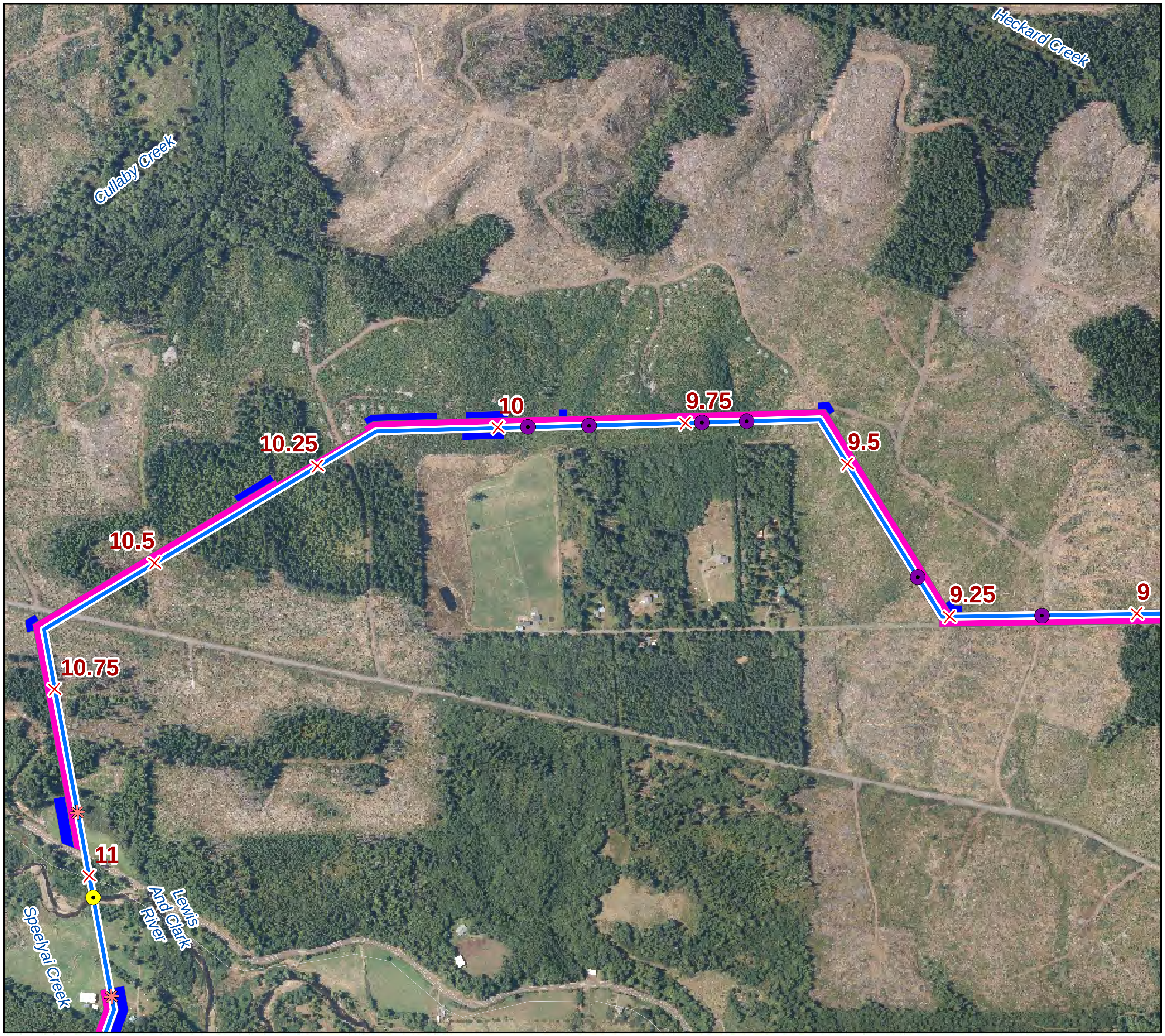


Figure 7
Aerial Maps of the Pipeline

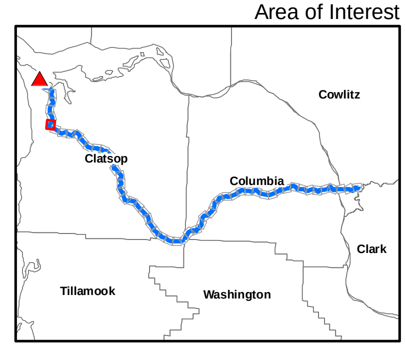
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 8
Aerial Maps of the Pipeline

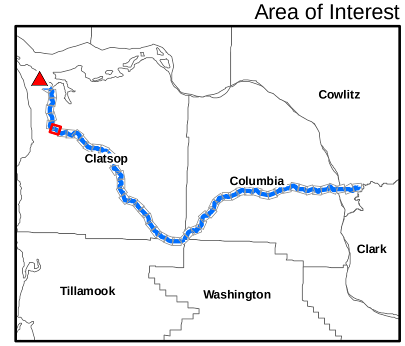
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

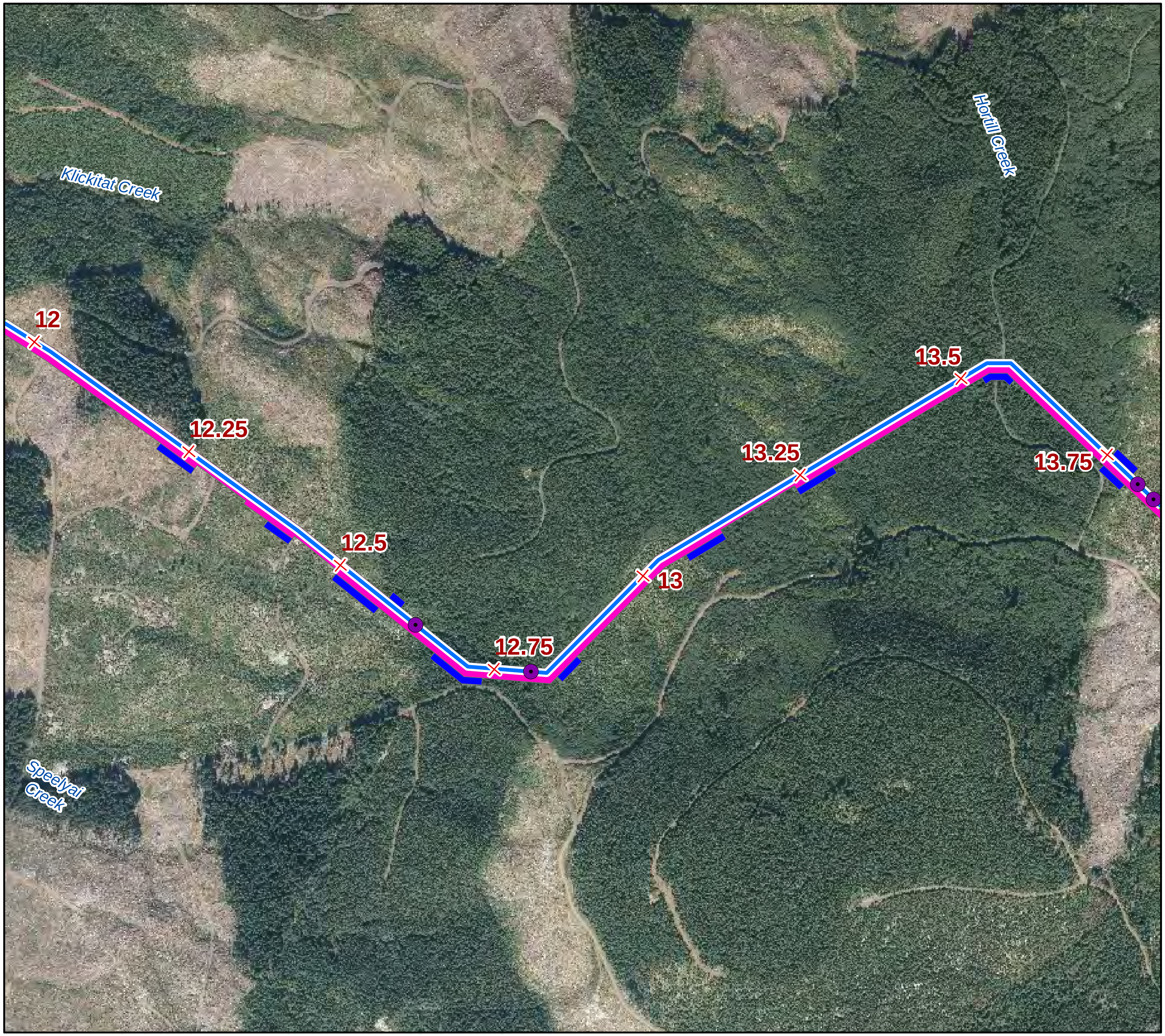


Figure 9
Aerial Maps of the Pipeline

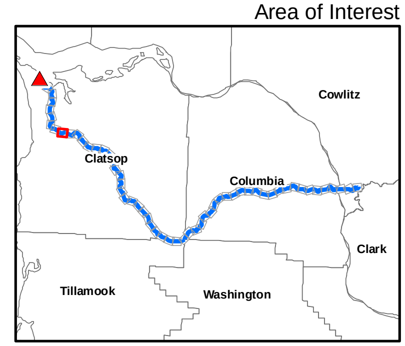
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 10
Aerial Maps of the Pipeline

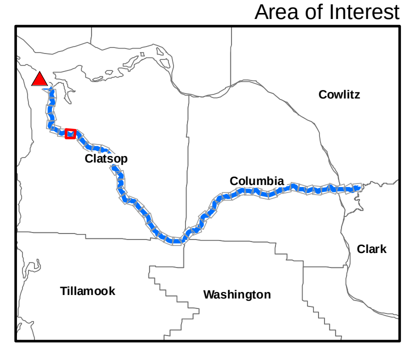
LEGEND

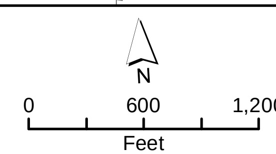
- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest





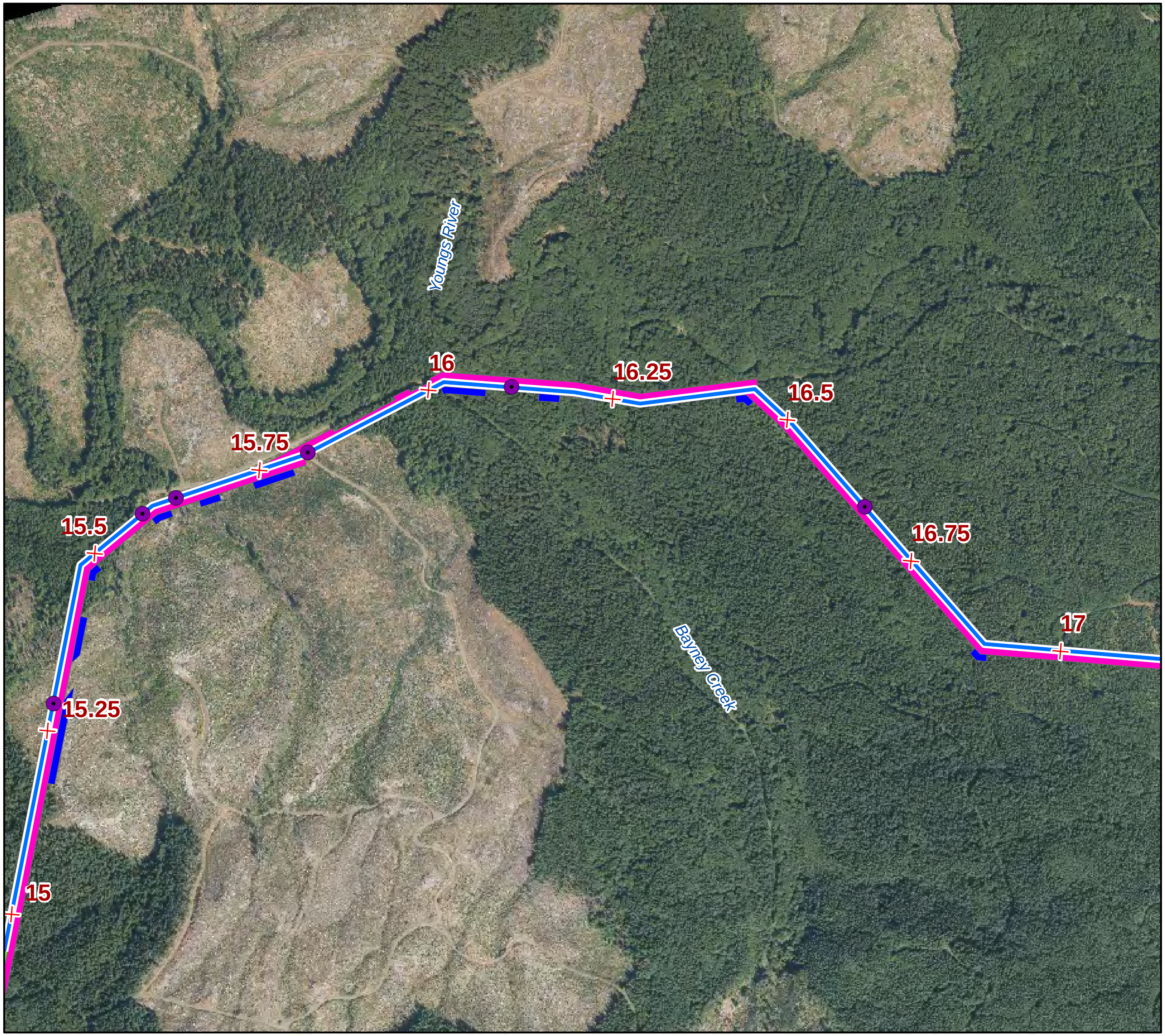


Figure 11
Aerial Maps of the Pipeline

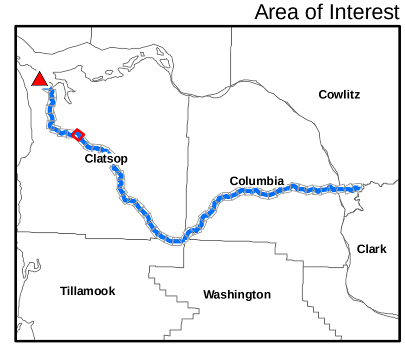
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

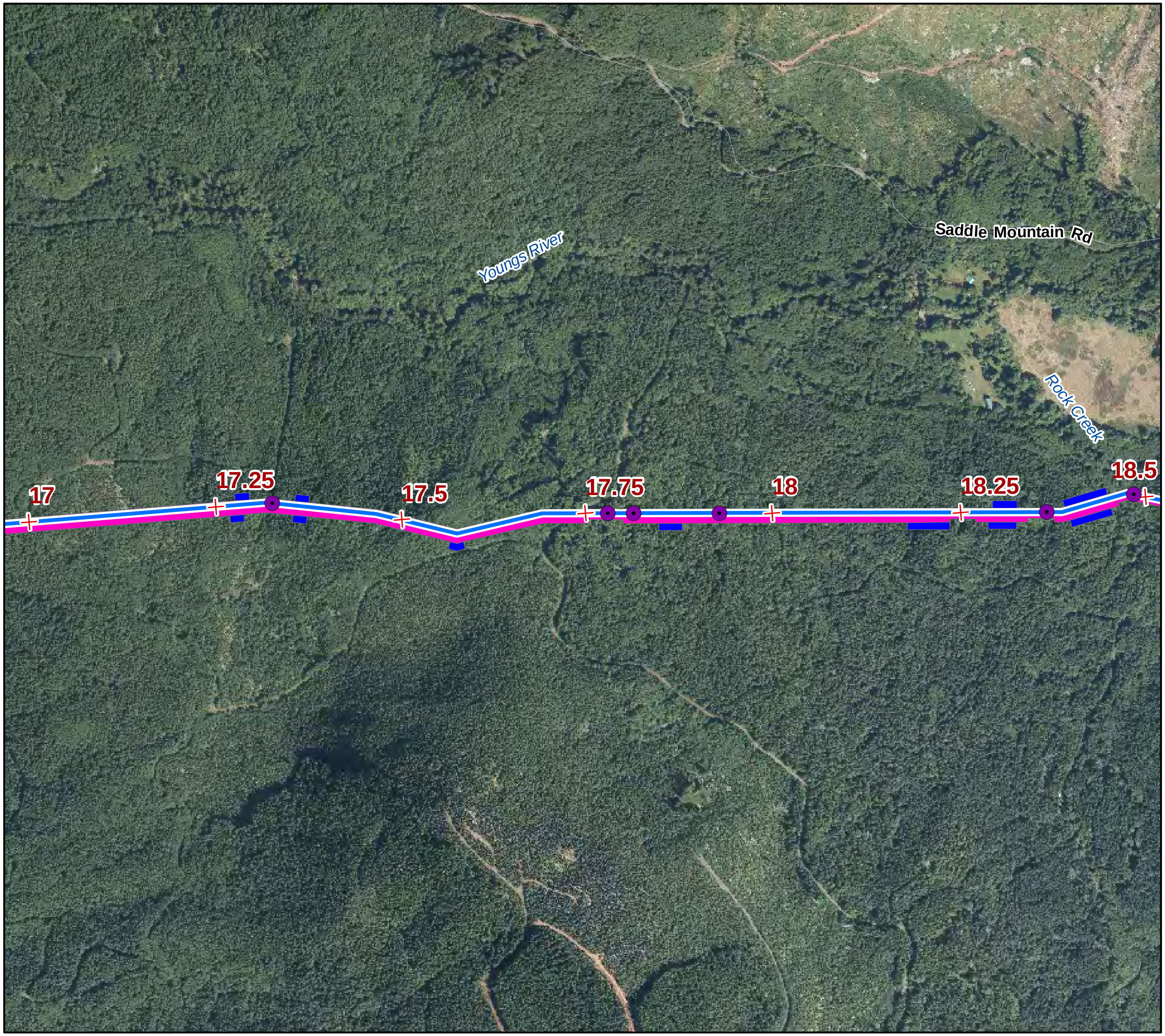


Figure 12
Aerial Maps of the Pipeline

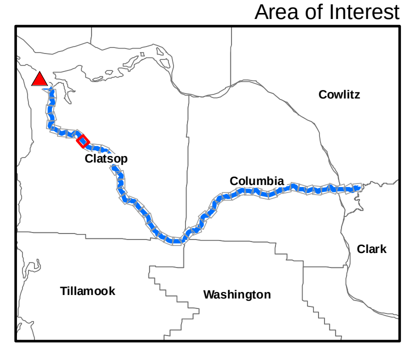
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

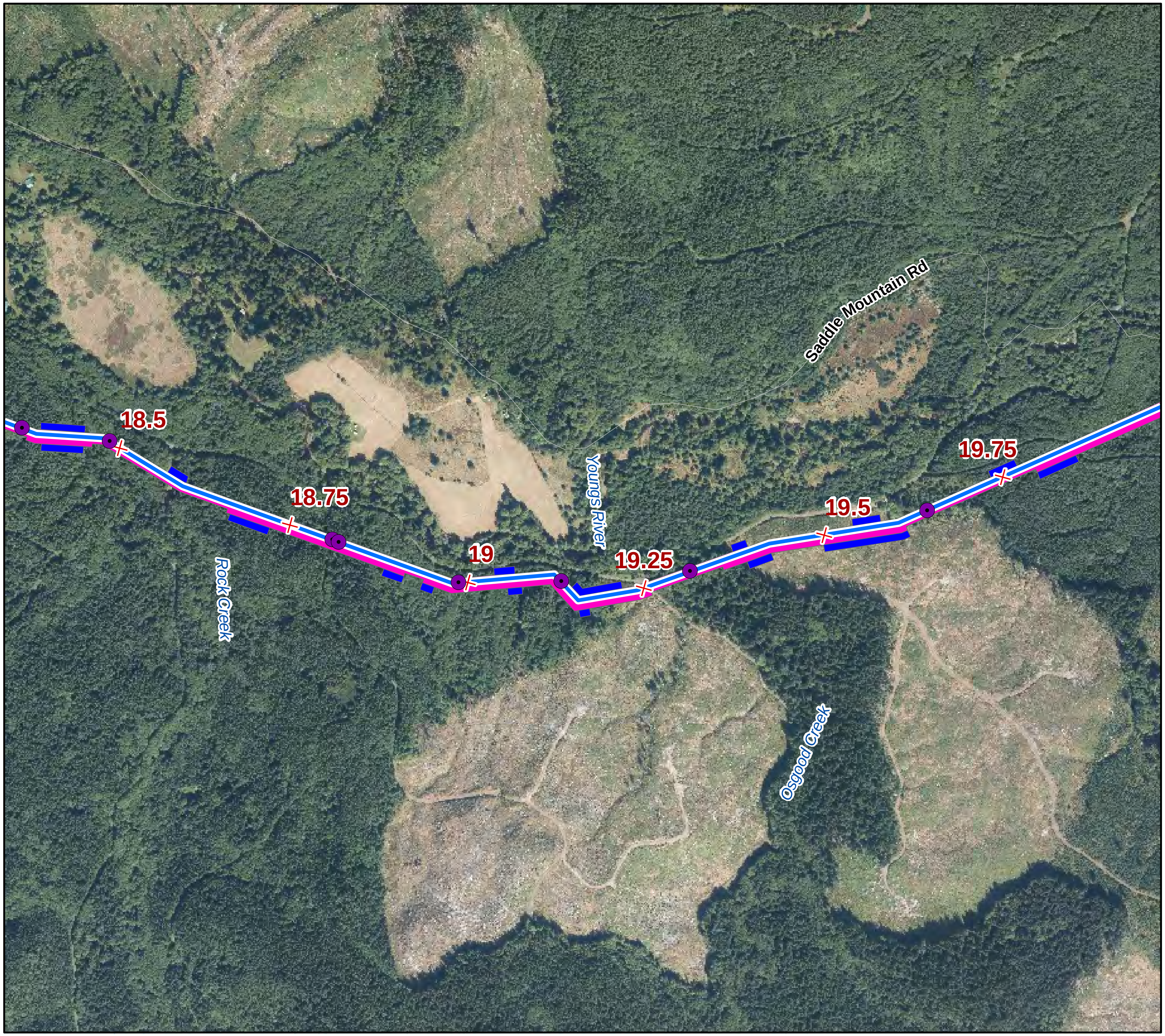
- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



0 600 1,200
Feet

Figure 13
Aerial Maps of the Pipeline



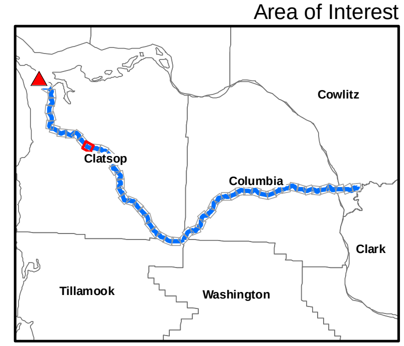
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



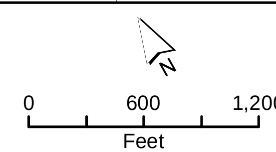


Figure 14
Aerial Maps of the Pipeline

LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest

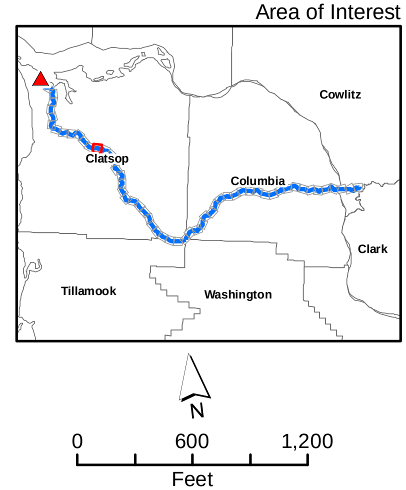
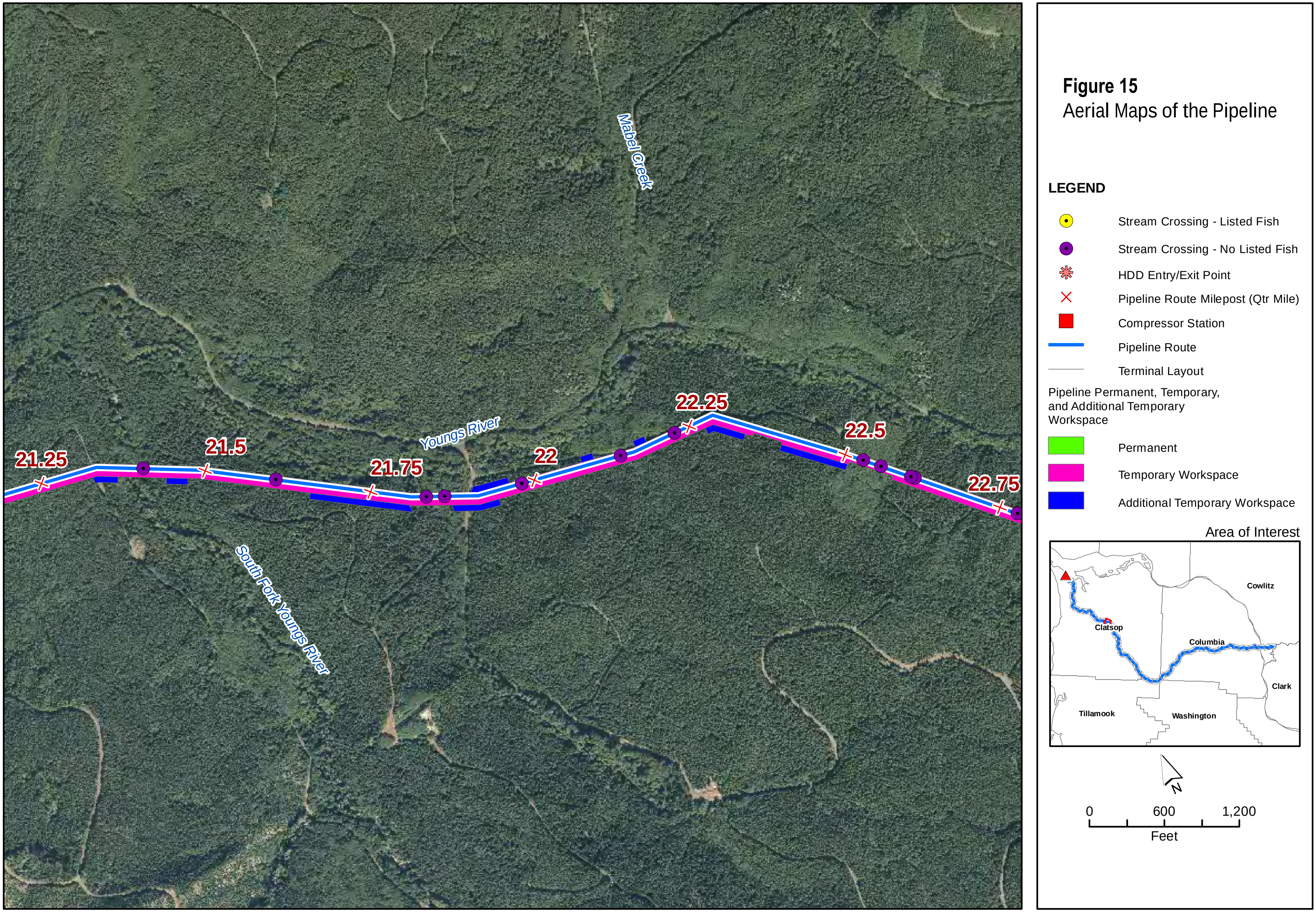


Figure 15
Aerial Maps of the Pipeline



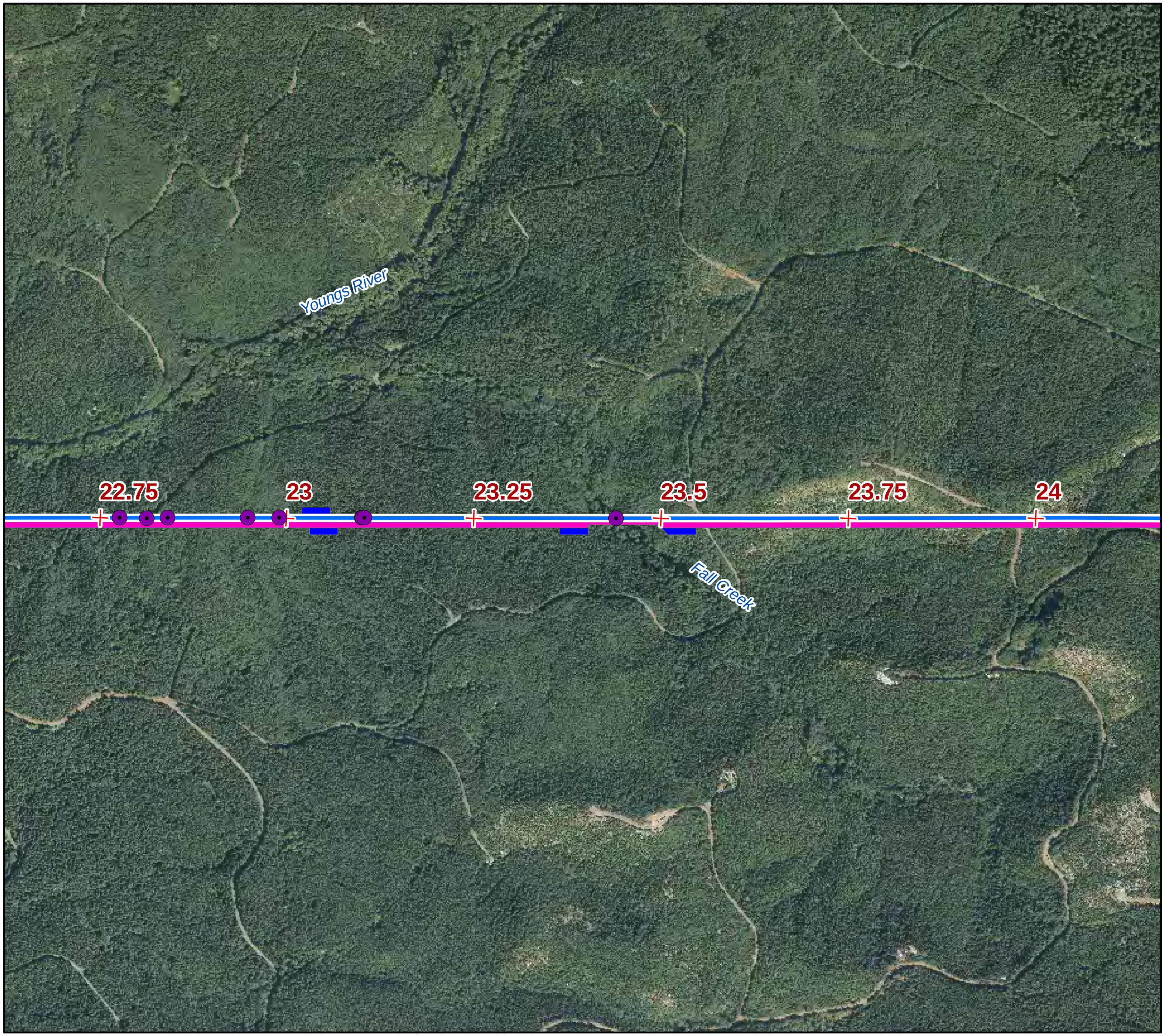


Figure 16
Aerial Maps of the Pipeline

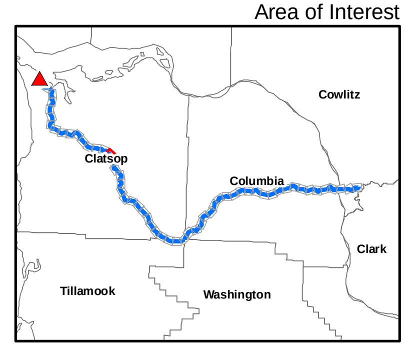
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

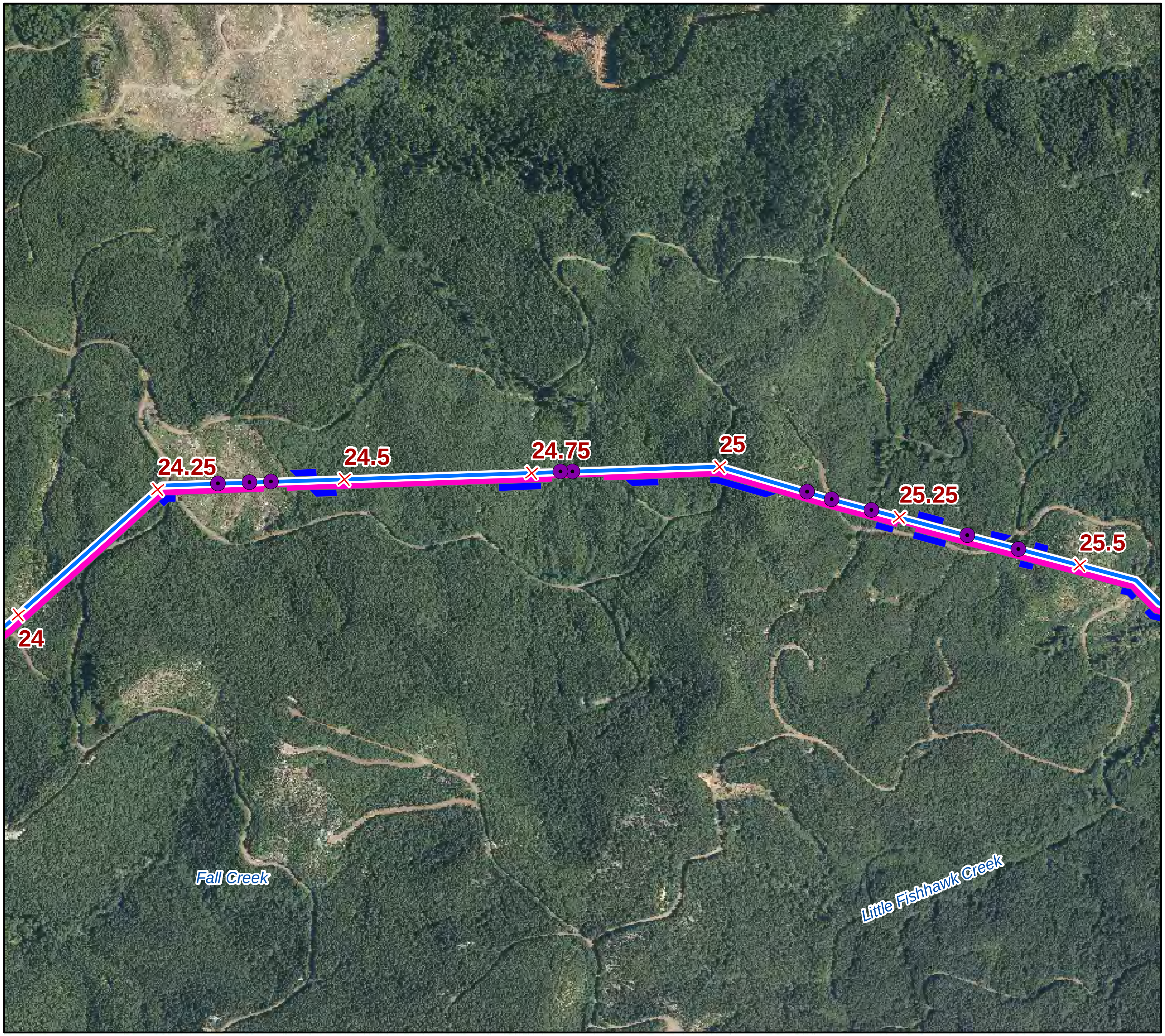


Figure 17
Aerial Maps of the Pipeline

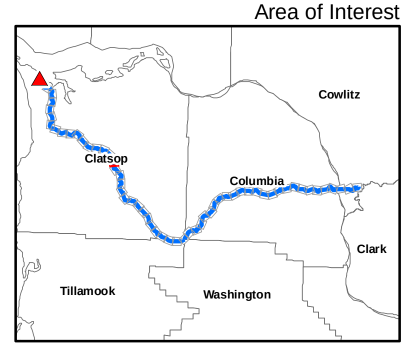
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

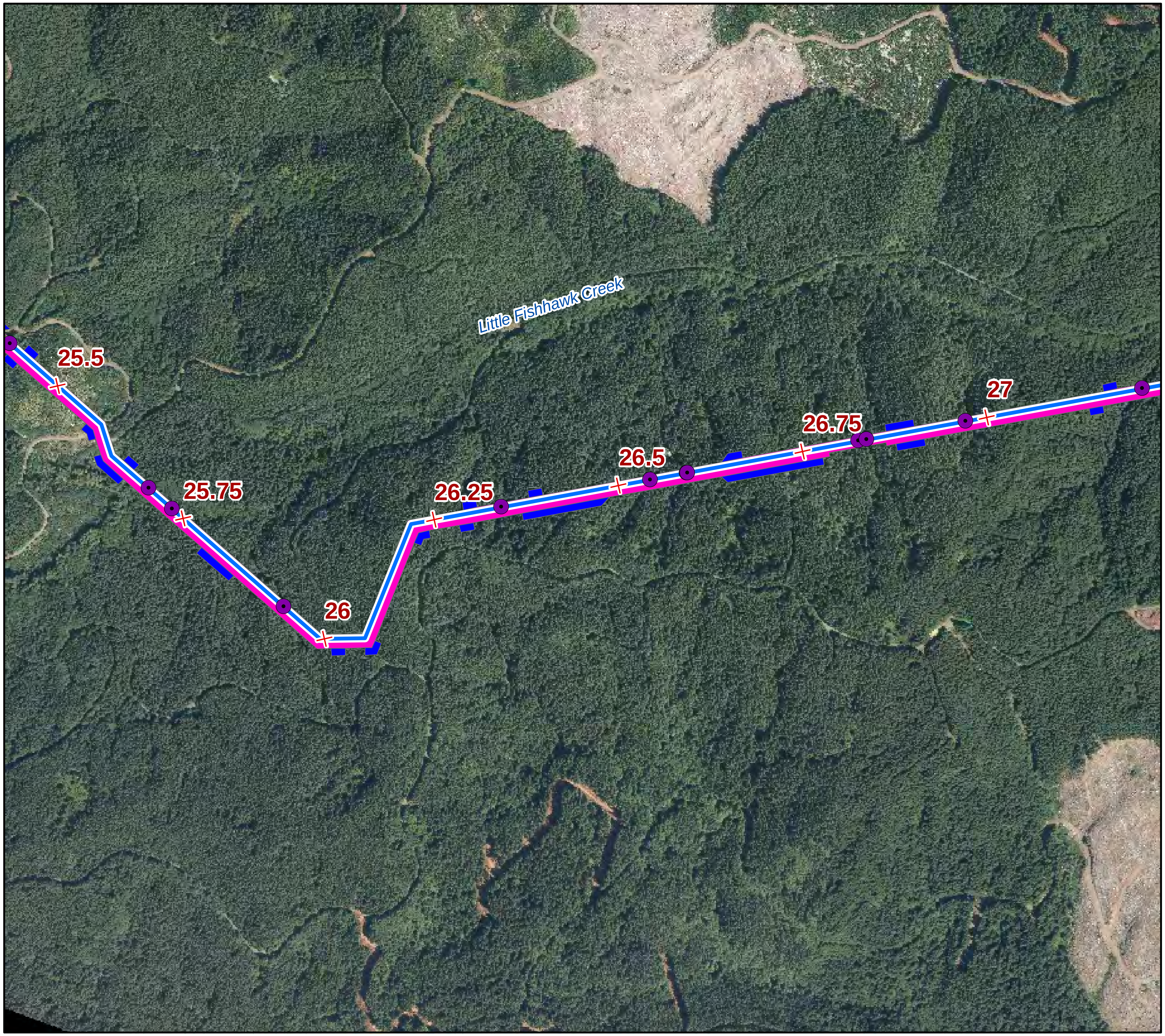
Area of Interest



N

0 600 1,200
Feet

Figure 18
Aerial Maps of the Pipeline



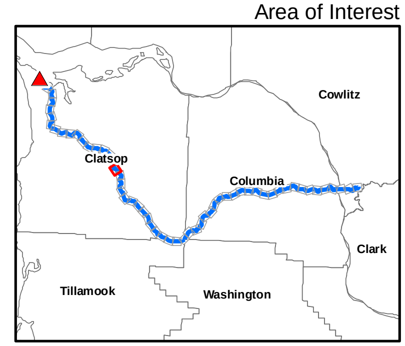
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



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Feet

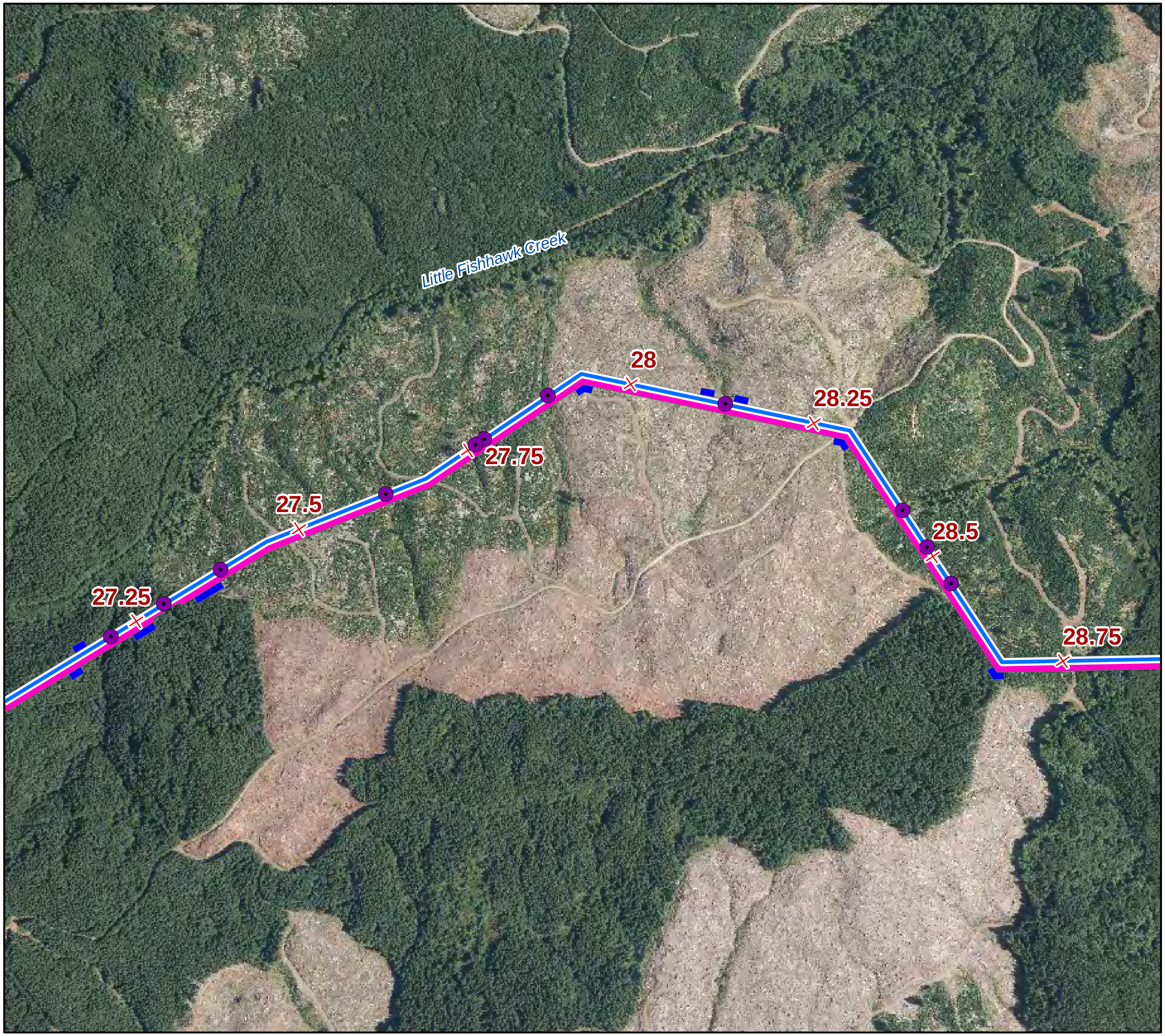


Figure 19
Aerial Maps of the Pipeline

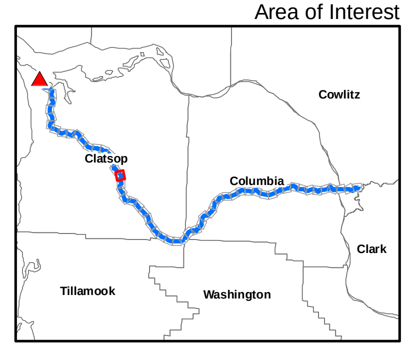
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



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Feet

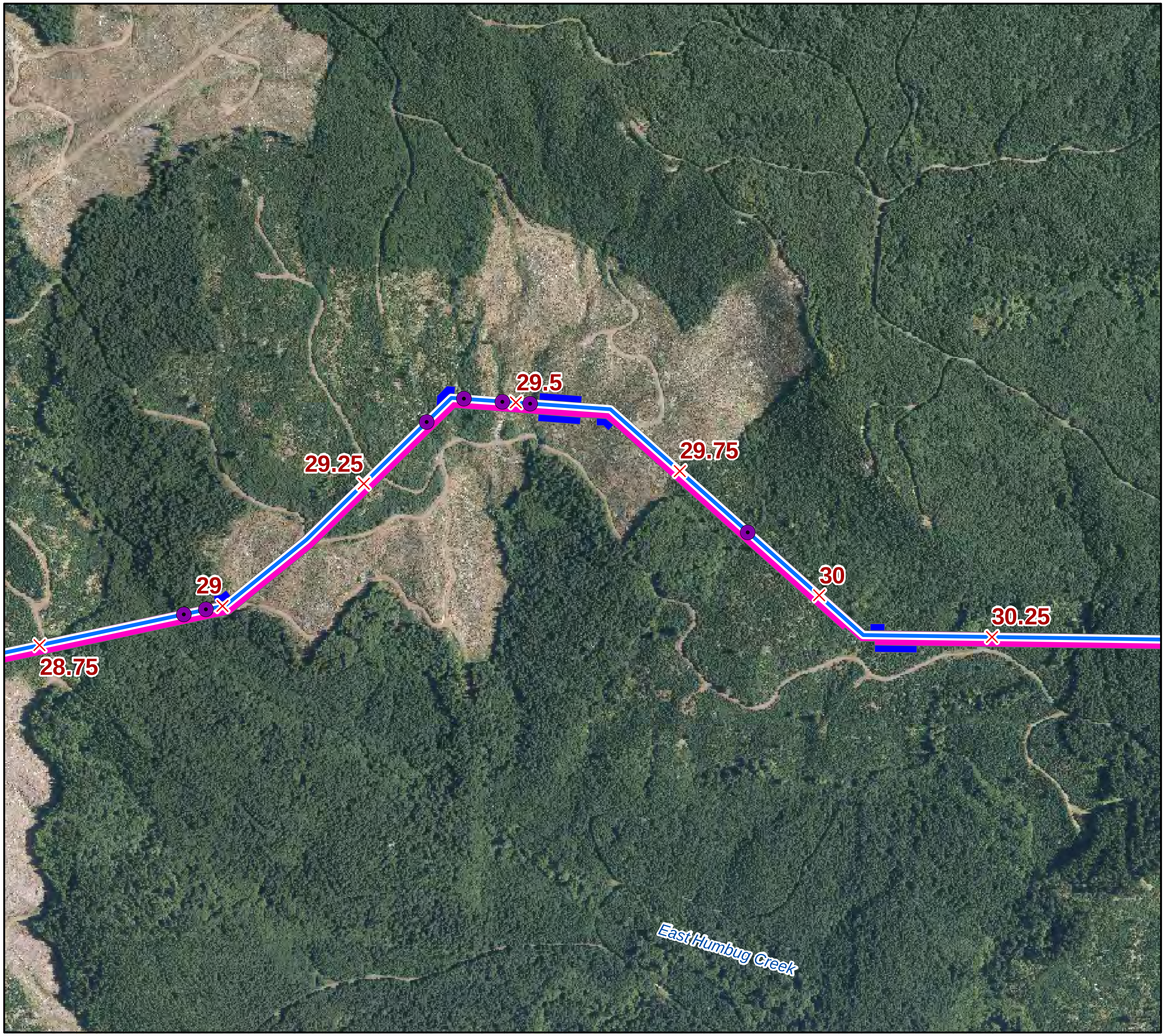


Figure 20
Aerial Maps of the Pipeline

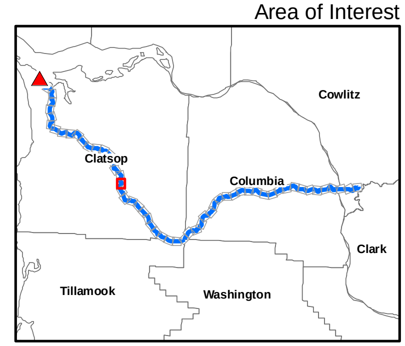
LEGEND

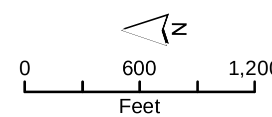
Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest





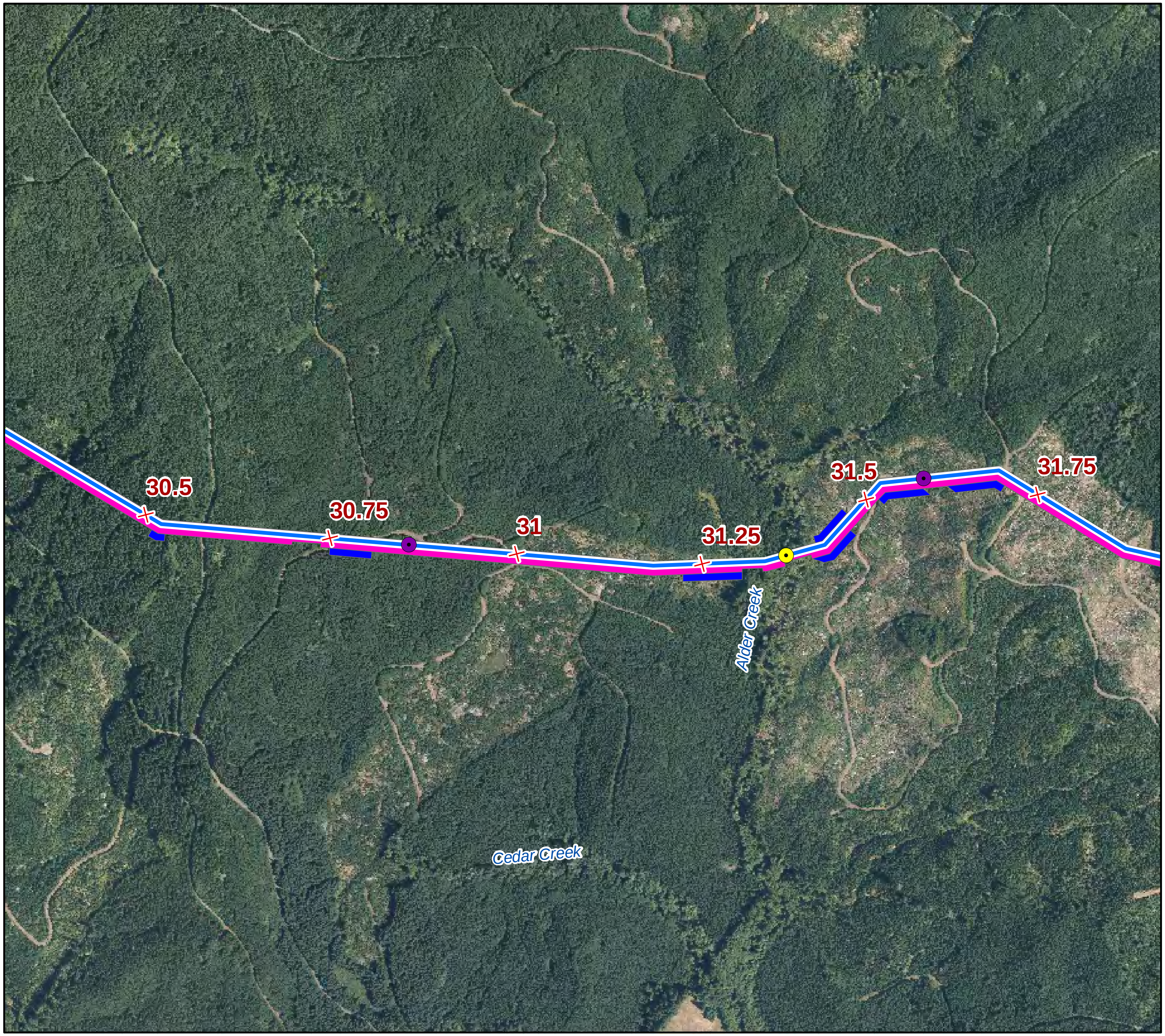
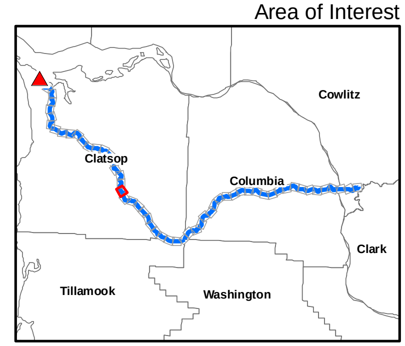


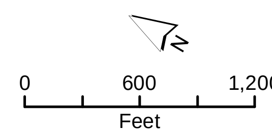
Figure 21
Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout
Pipeline Permanent, Temporary, and Additional Temporary Workspace
Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest





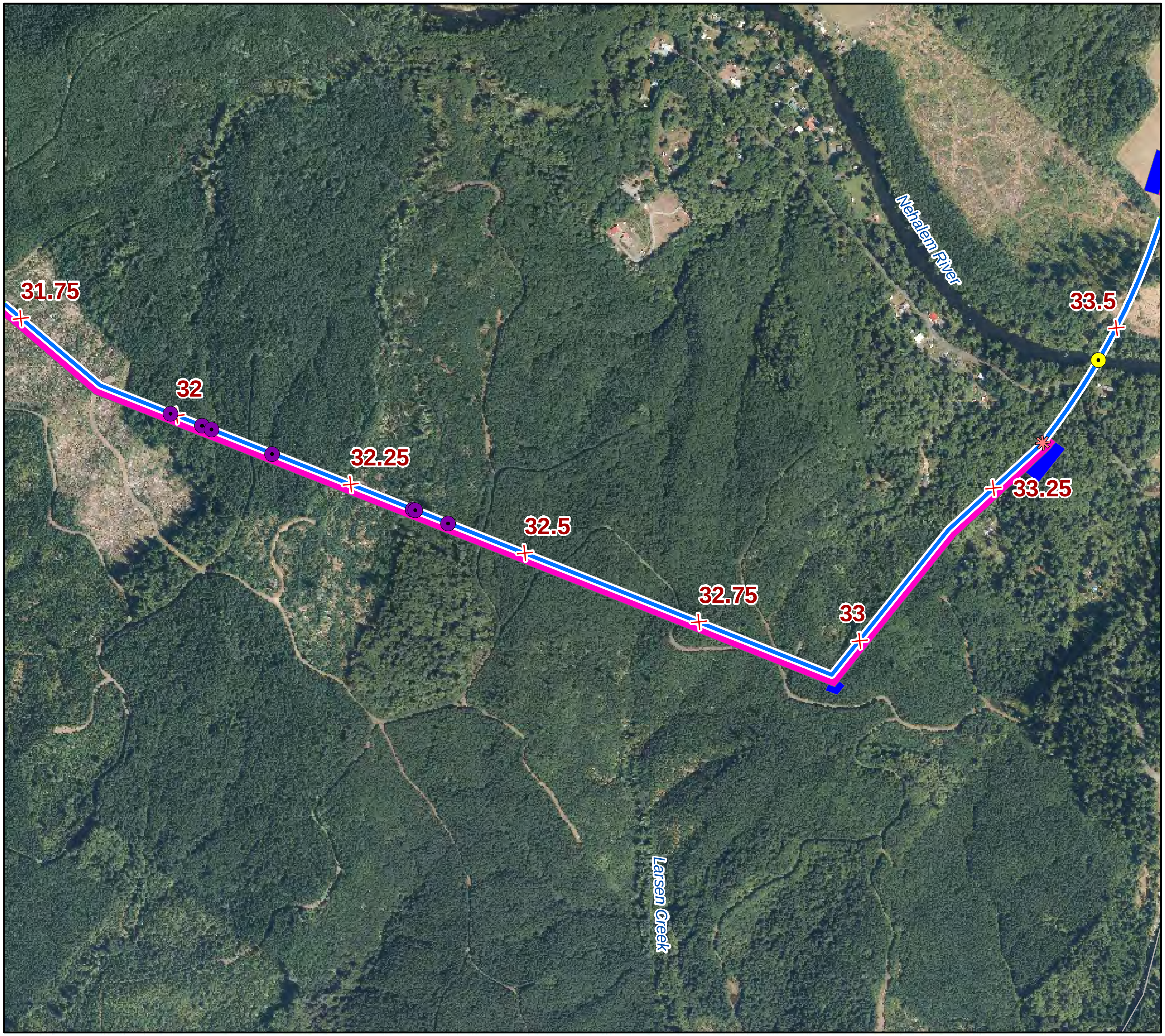


Figure 22
Aerial Maps of the Pipeline

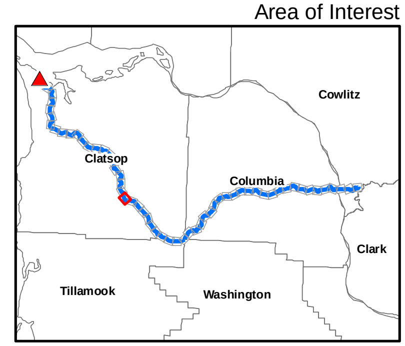
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



0 600 1,200
Feet

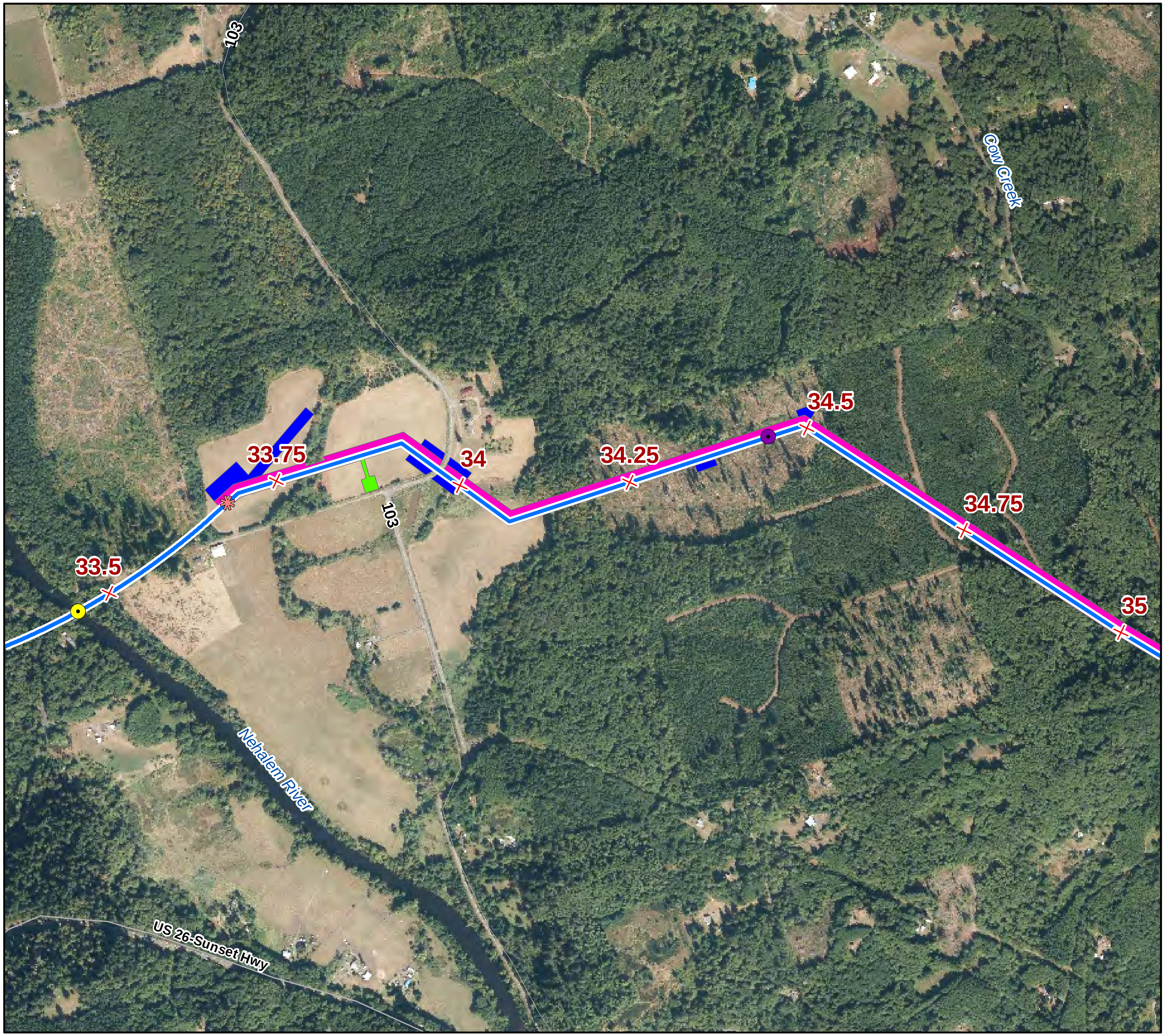


Figure 23
Aerial Maps of the Pipeline

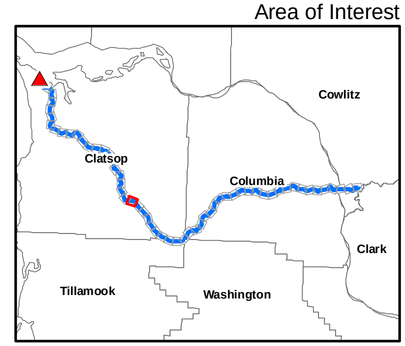
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

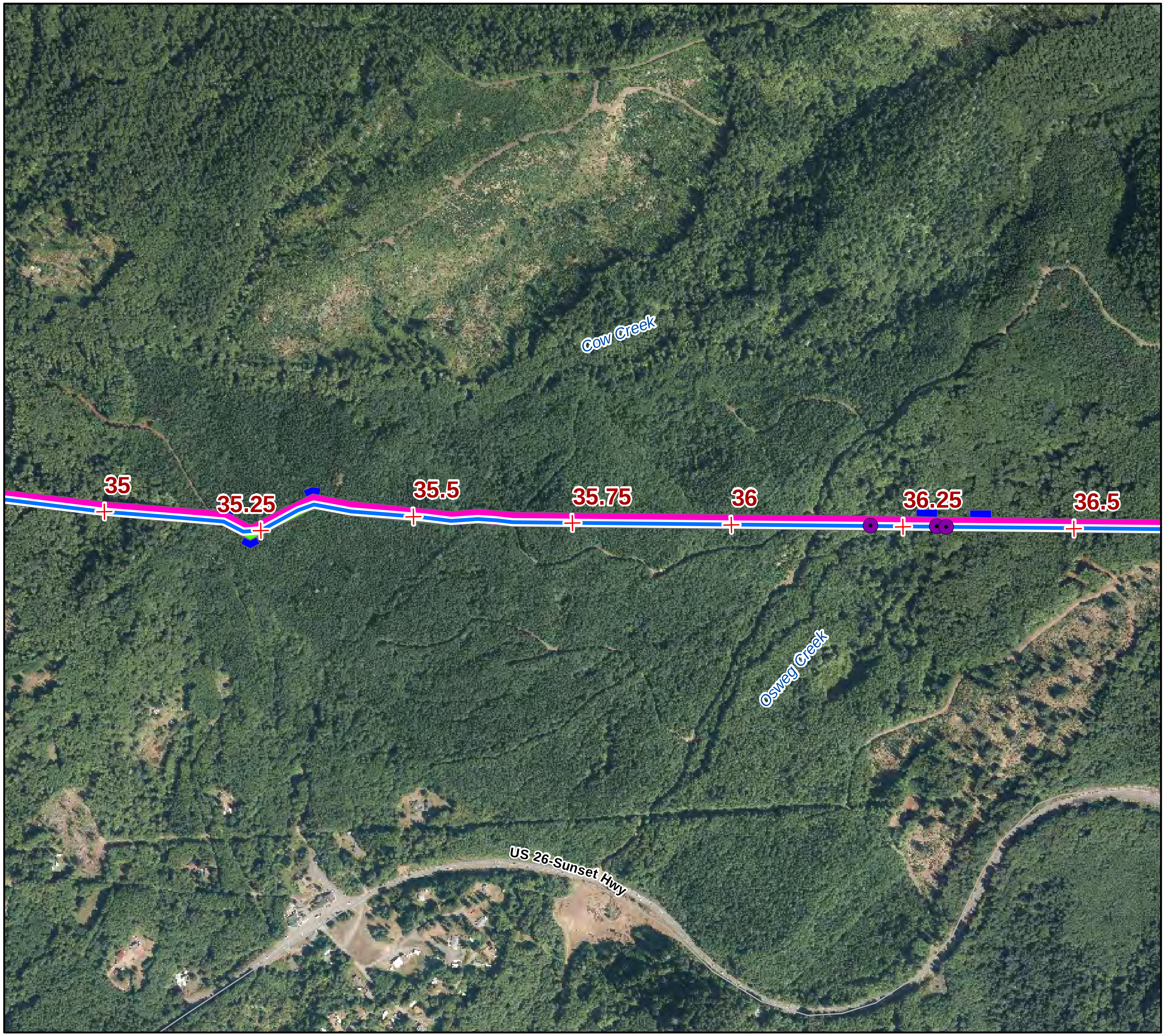
Area of Interest



N

0 600 1,200
Feet

Figure 24
Aerial Maps of the Pipeline



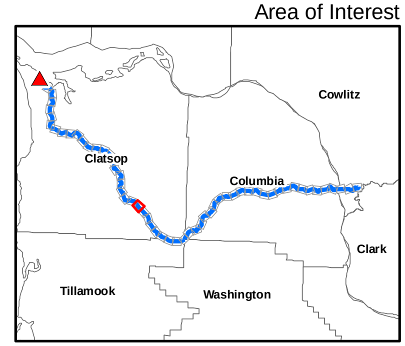
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



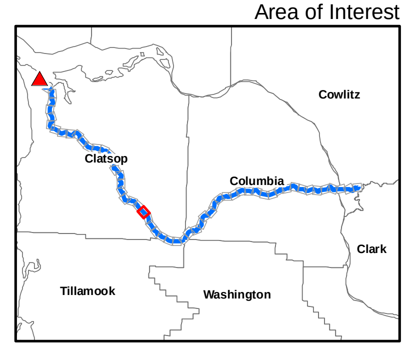
0 600 1,200
Feet

Figure 25
Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout
Pipeline Permanent, Temporary, and Additional Temporary Workspace
Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



0 600 1,200
Feet

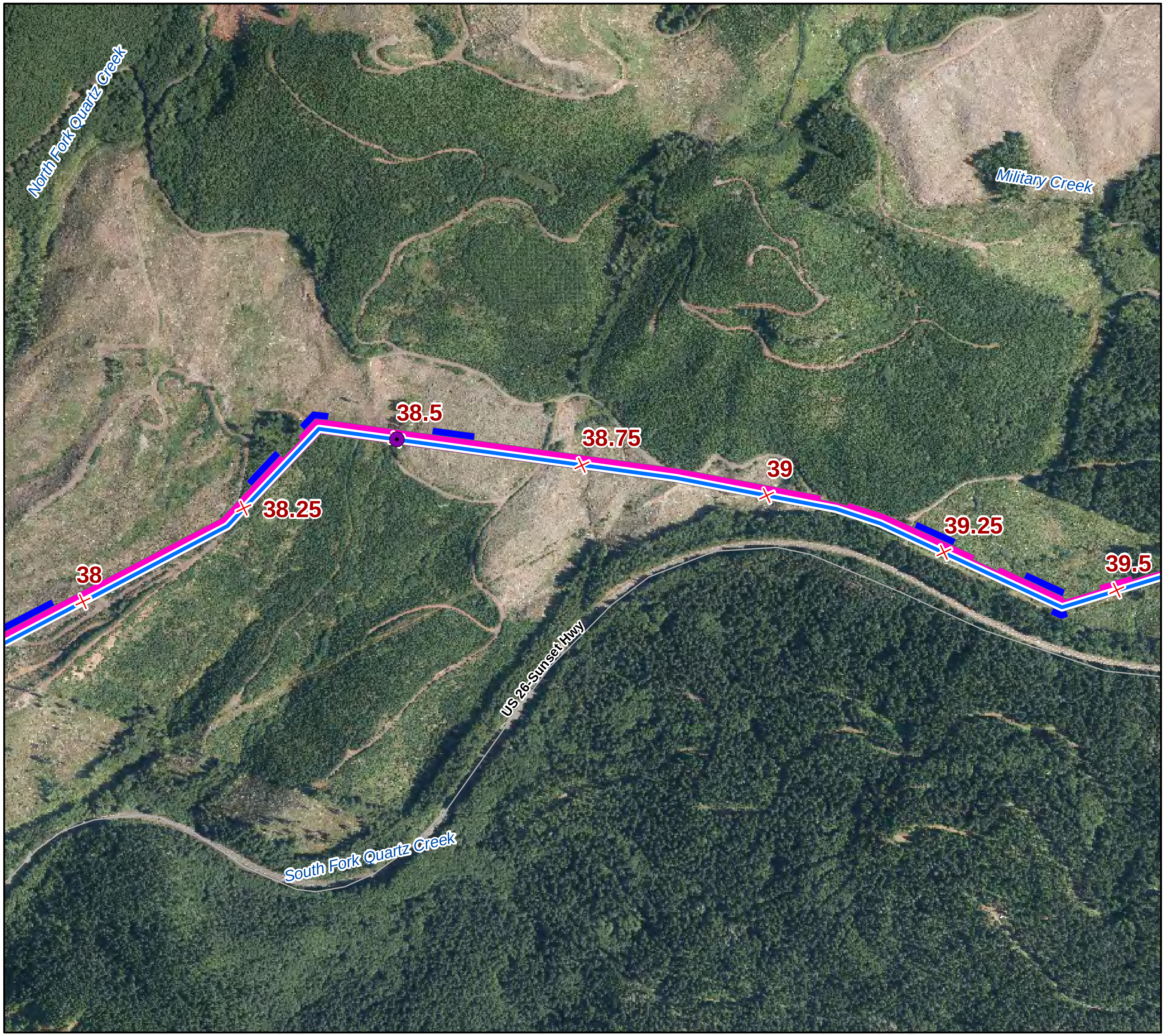


Figure 26
Aerial Maps of the Pipeline

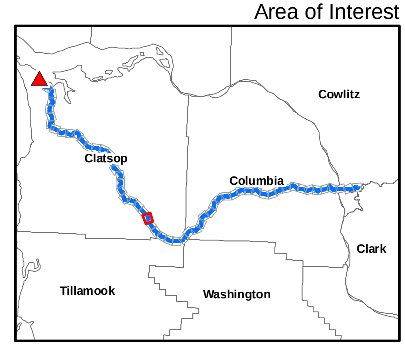
LEGEND

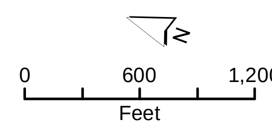
Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest





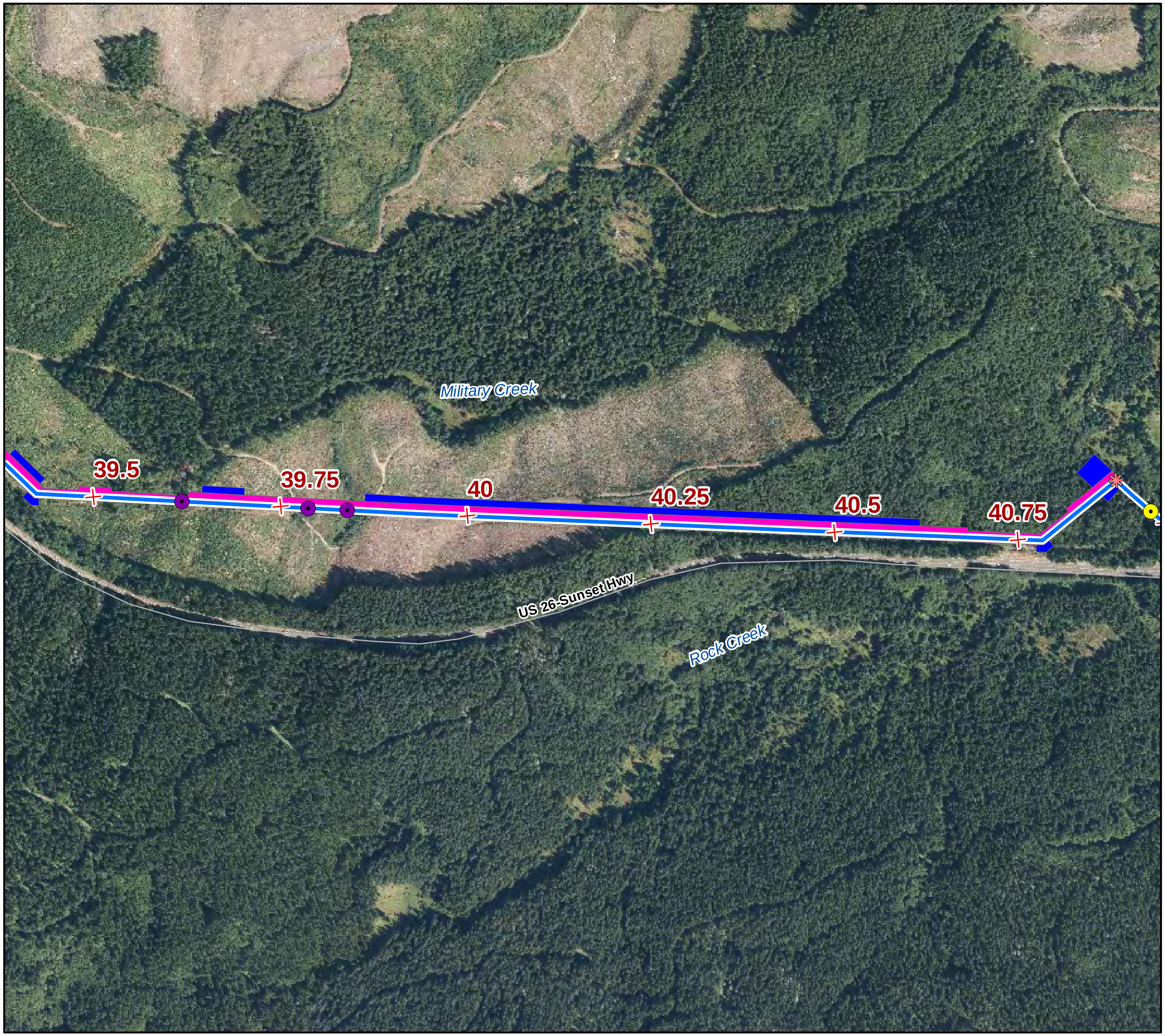
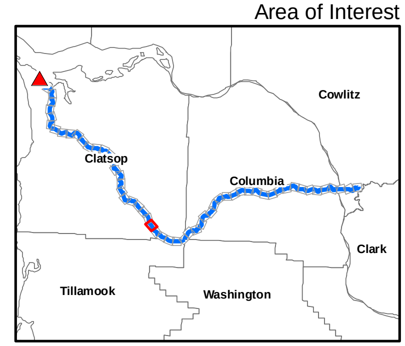


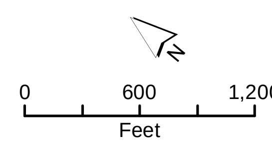
Figure 27
Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout
Pipeline Permanent, Temporary, and Additional Temporary Workspace
Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest





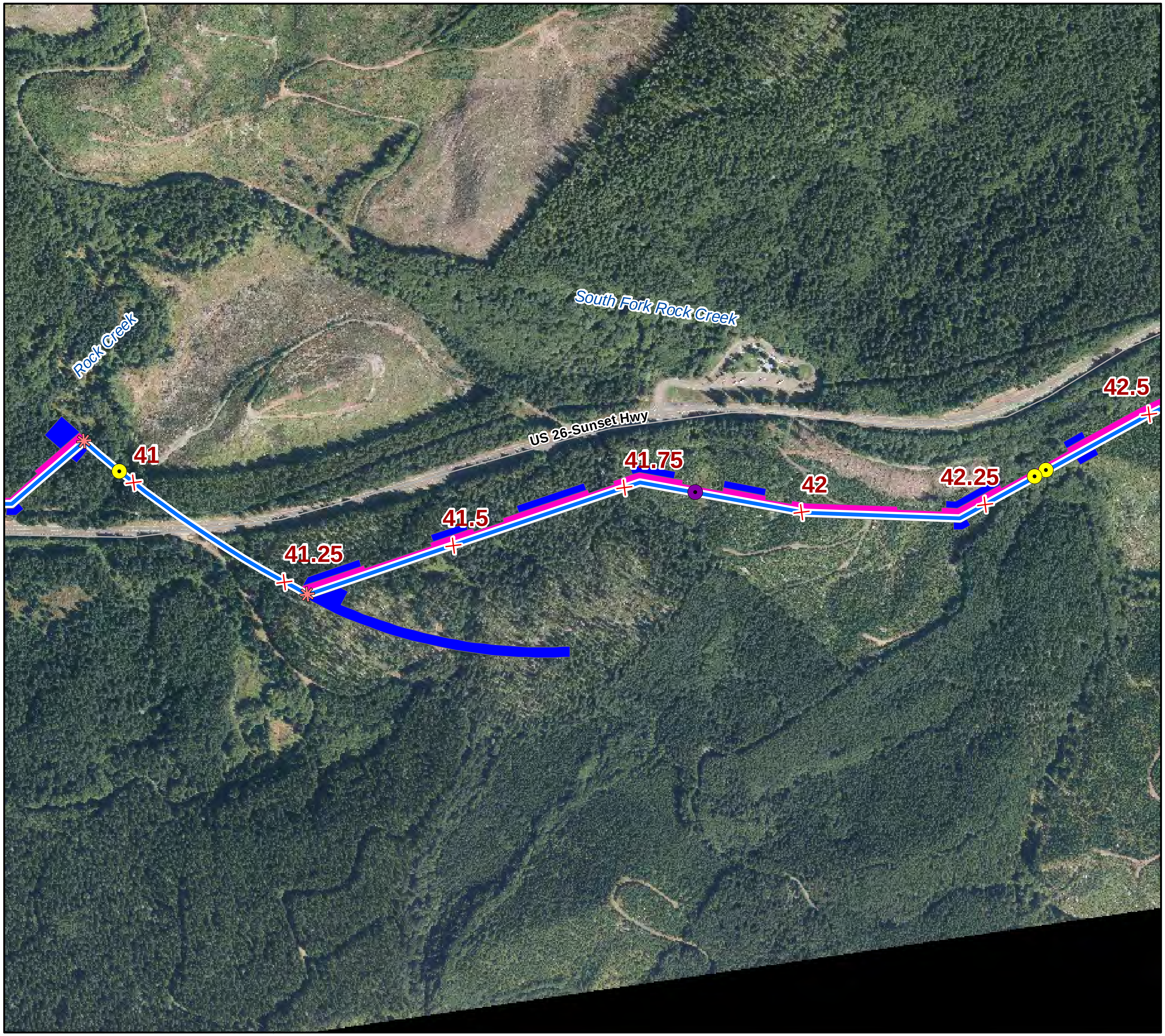


Figure 28
Aerial Maps of the Pipeline

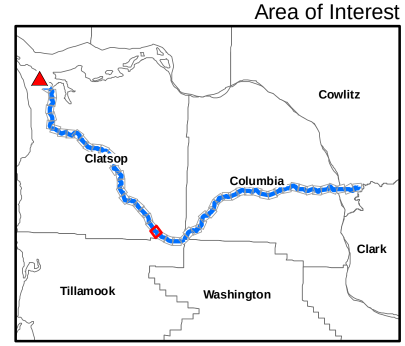
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

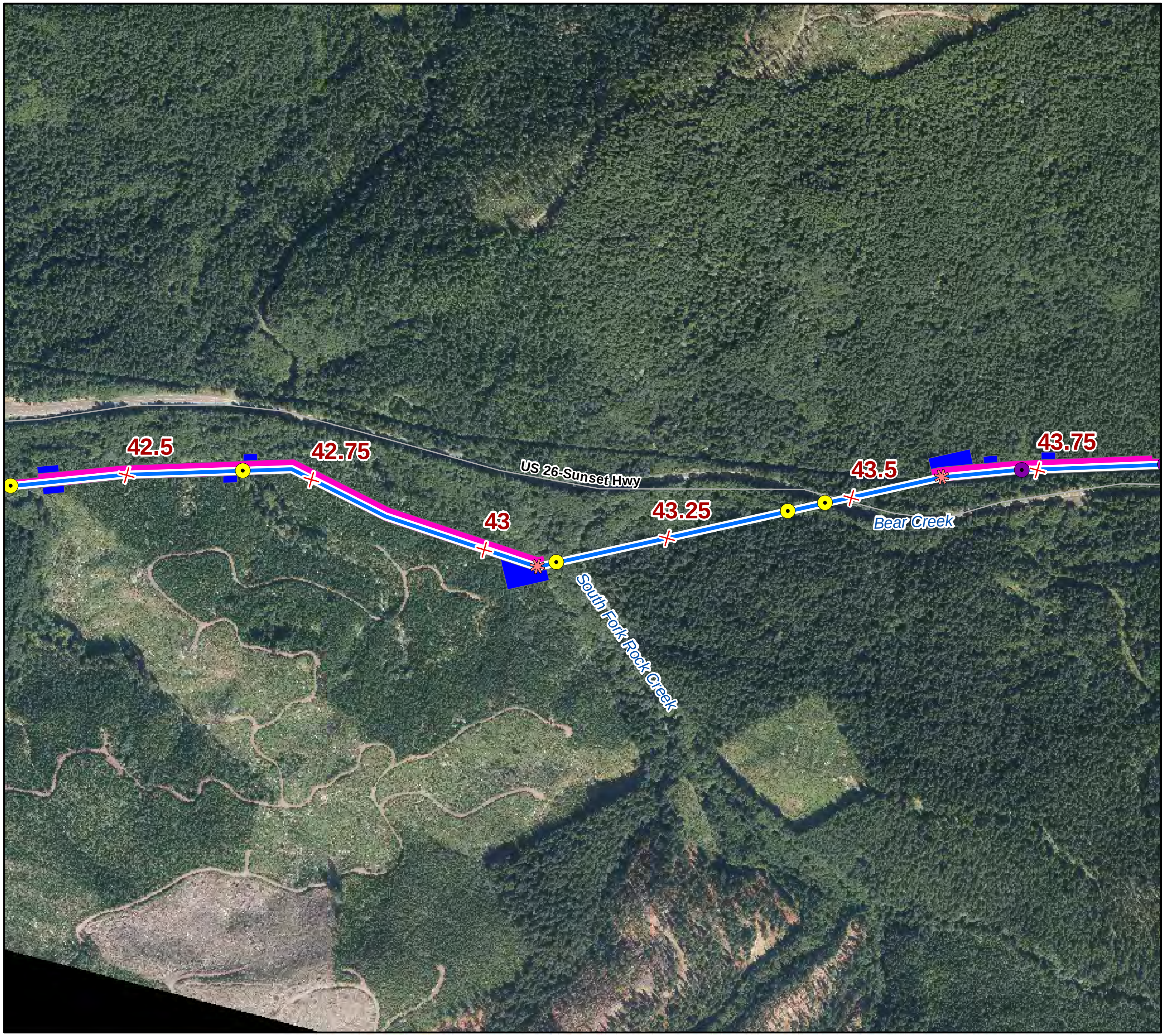
- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



0 600 1,200
Feet

Figure 29
Aerial Maps of the Pipeline



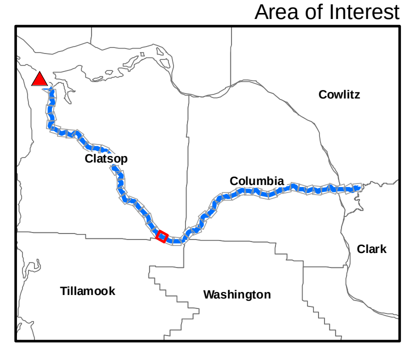
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



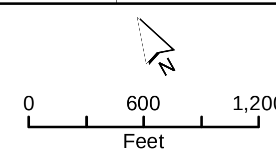
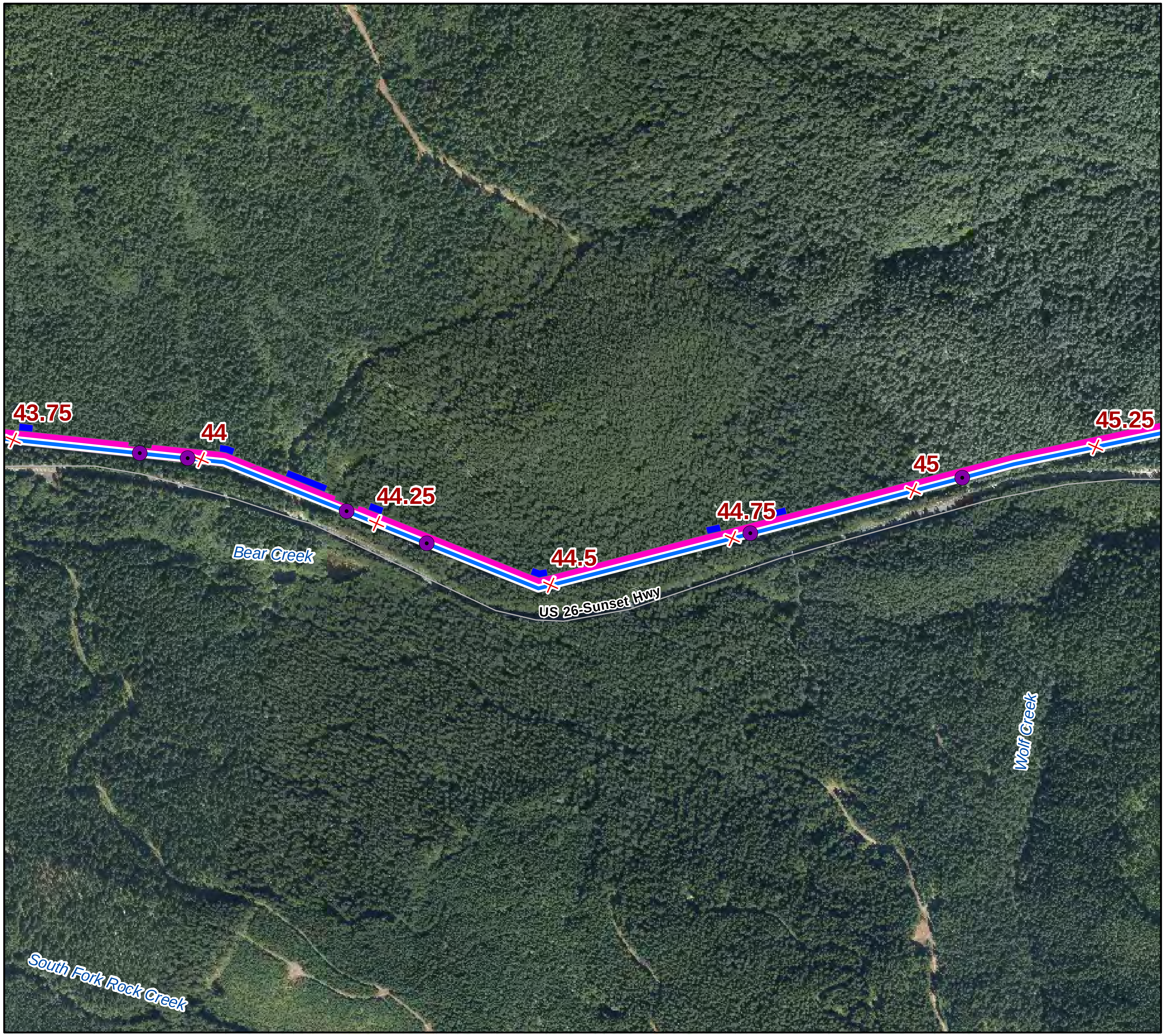


Figure 30
Aerial Maps of the Pipeline



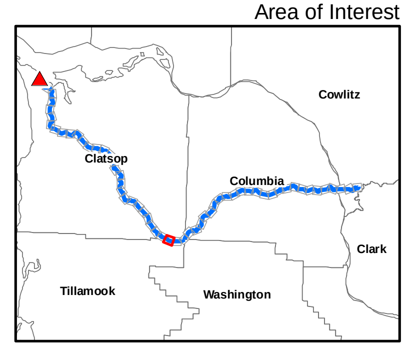
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 31
Aerial Maps of the Pipeline

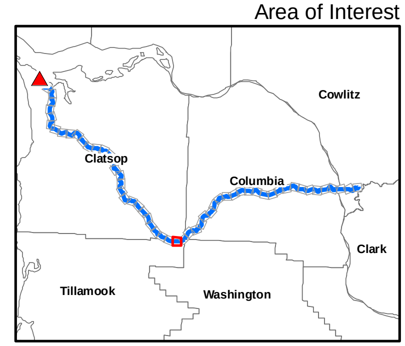
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 32
Aerial Maps of the Pipeline

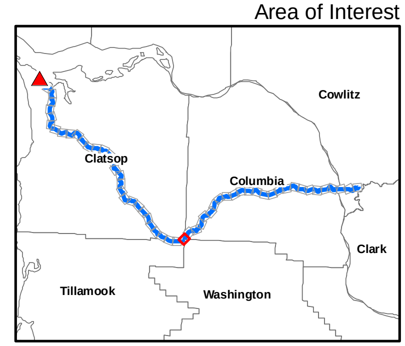
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



0 600 1,200
Feet

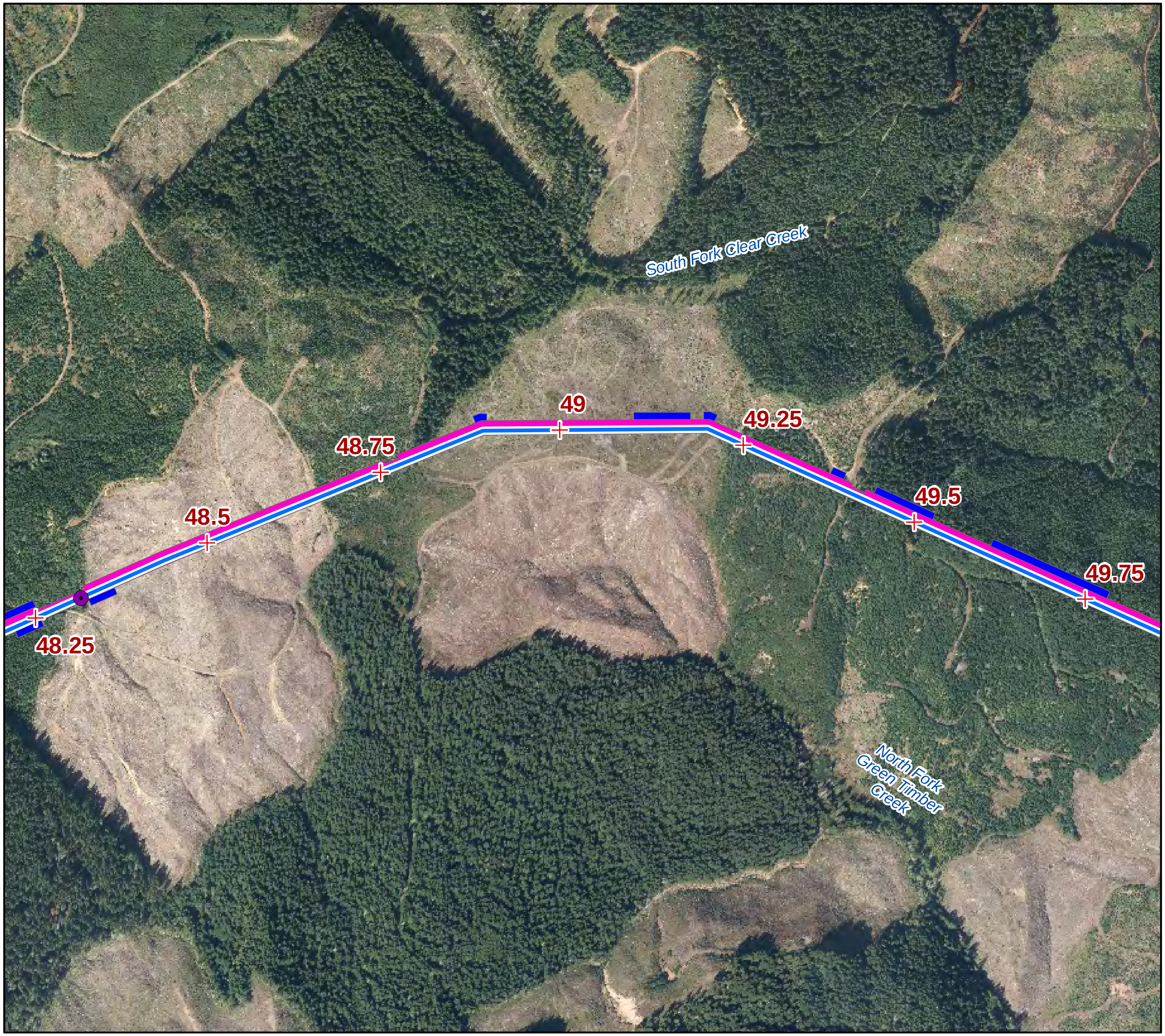


Figure 33
Aerial Maps of the Pipeline

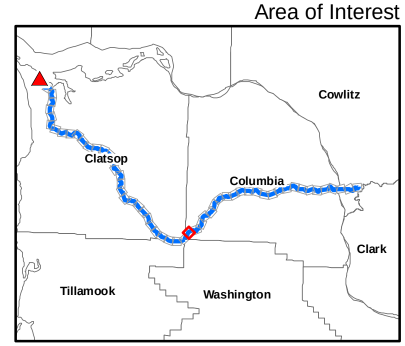
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



0 600 1,200
Feet

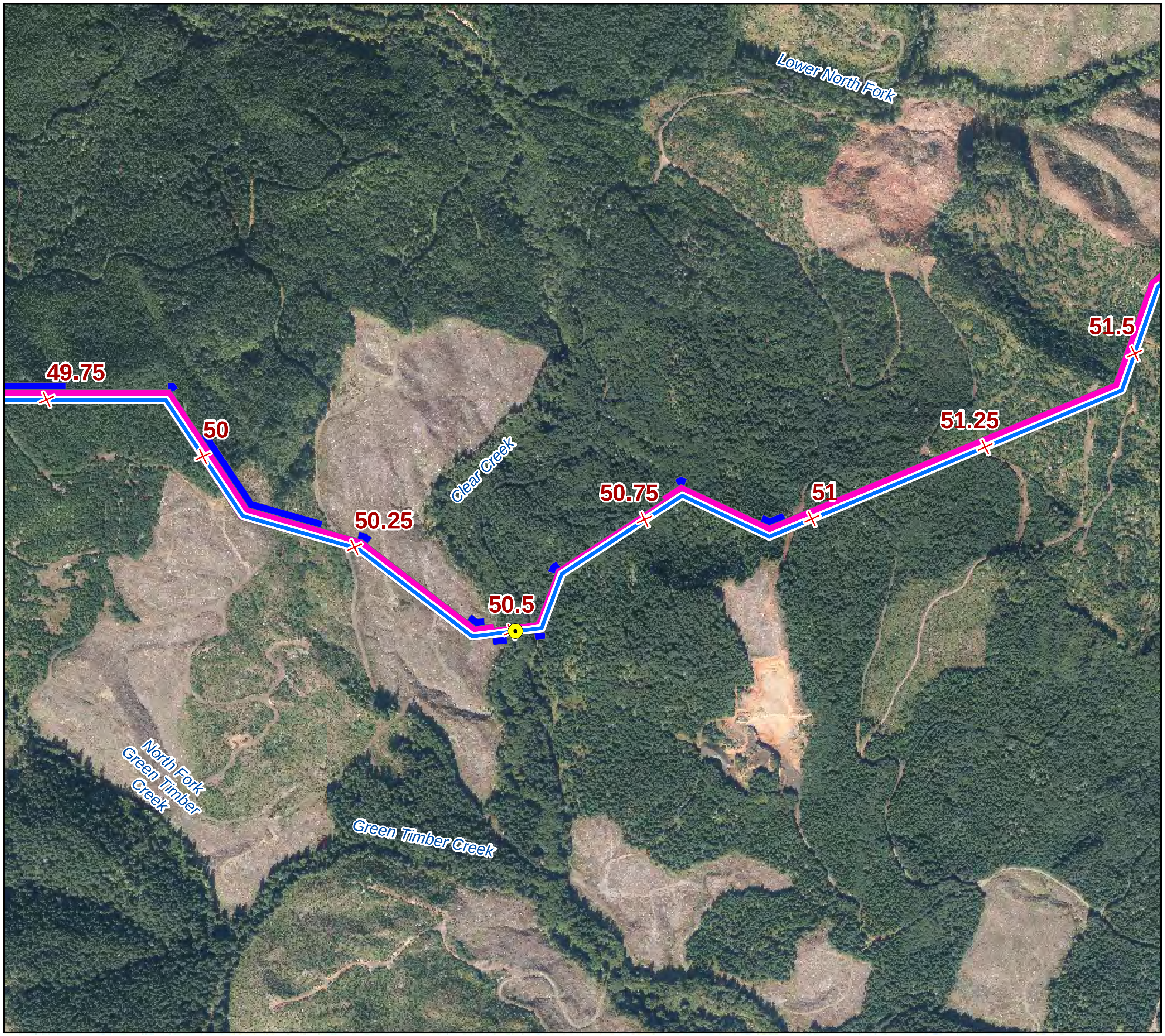
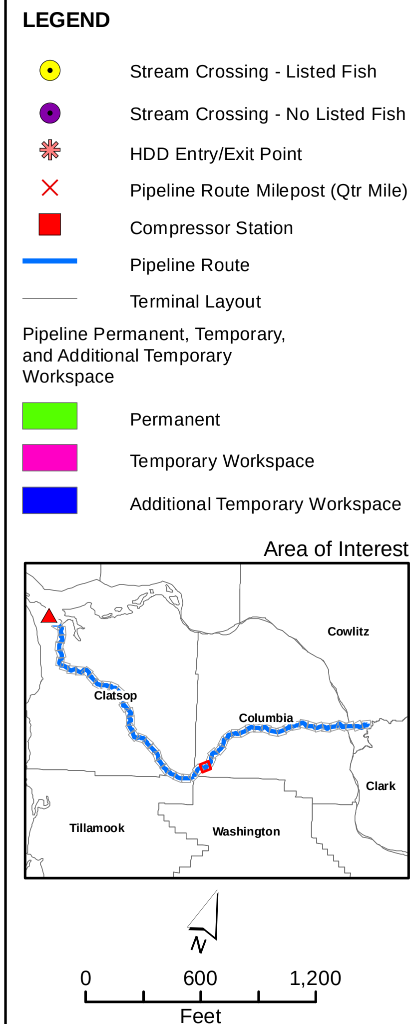


Figure 34
Aerial Maps of the Pipeline



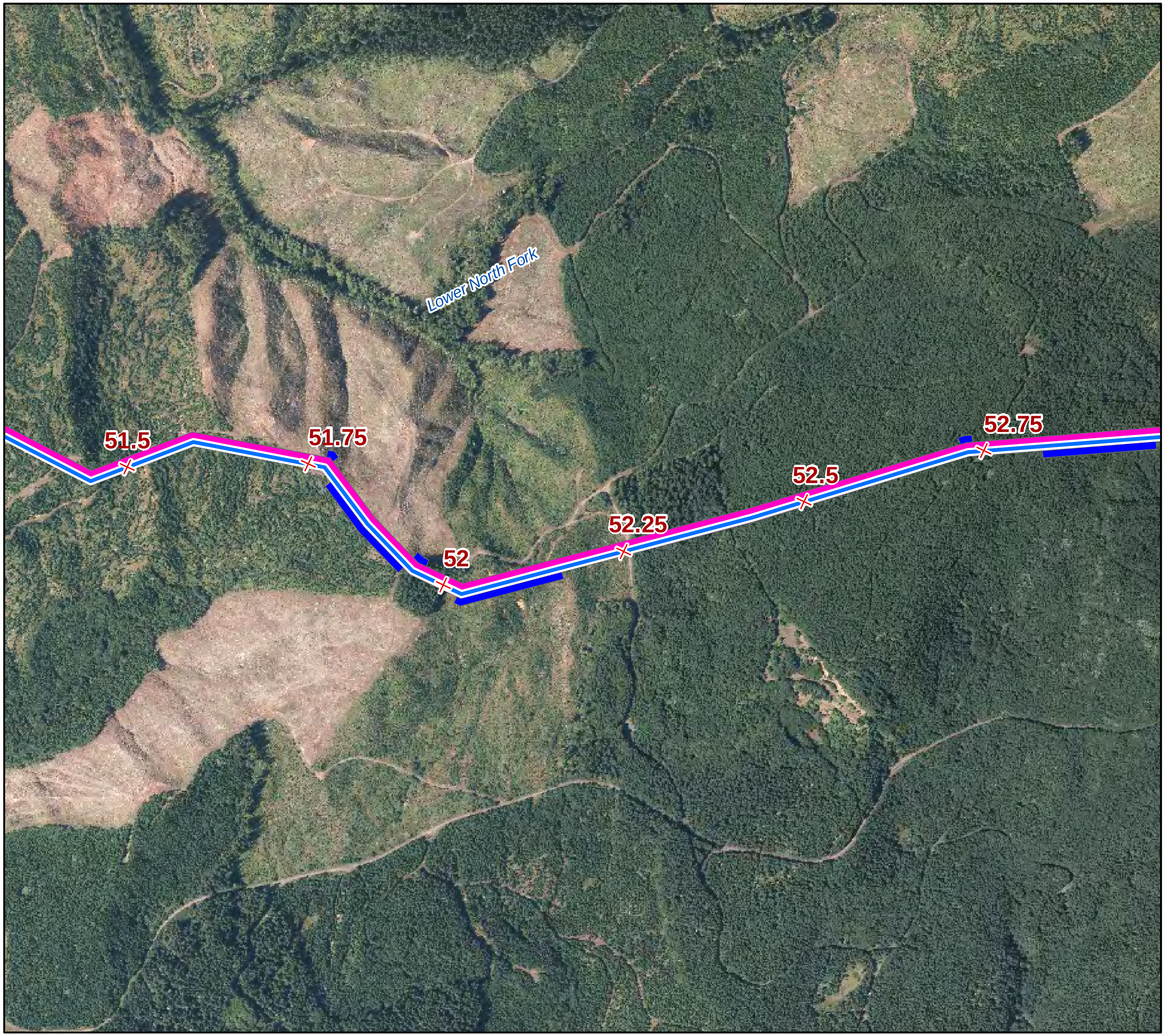
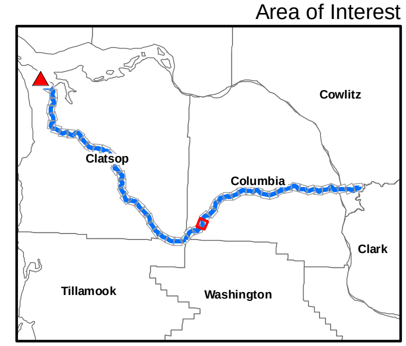


Figure 35
Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout
Pipeline Permanent, Temporary, and Additional Temporary Workspace
Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



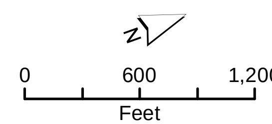


Figure 36
Aerial Maps of the Pipeline

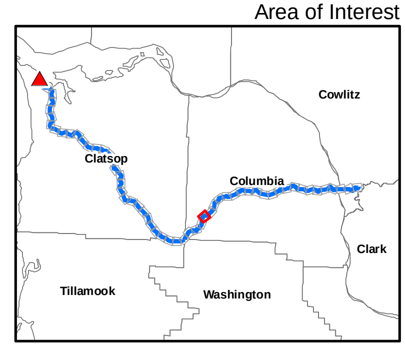
LEGEND

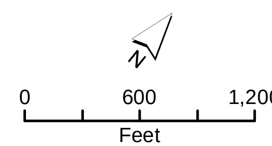
- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest





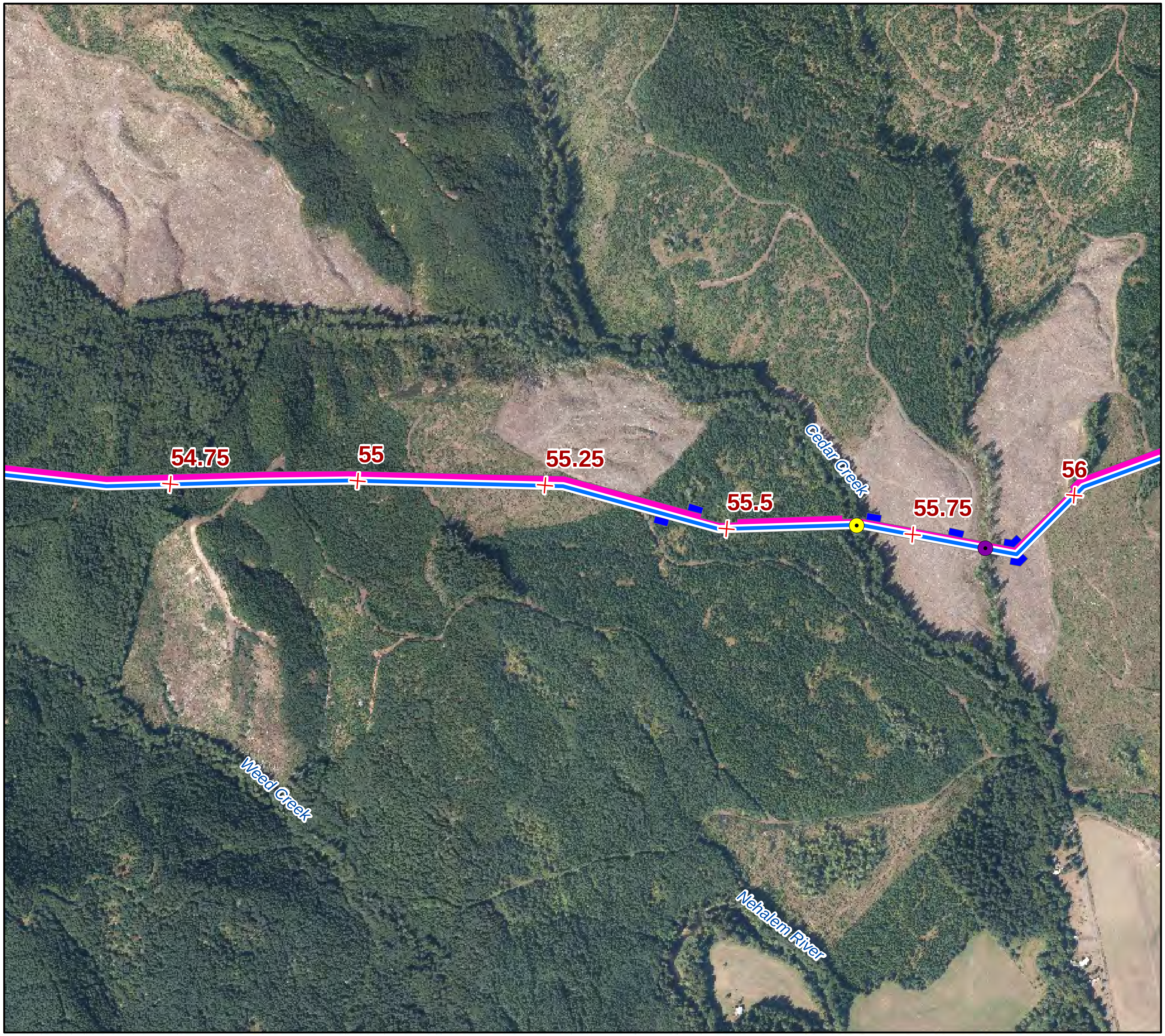


Figure 37
Aerial Maps of the Pipeline

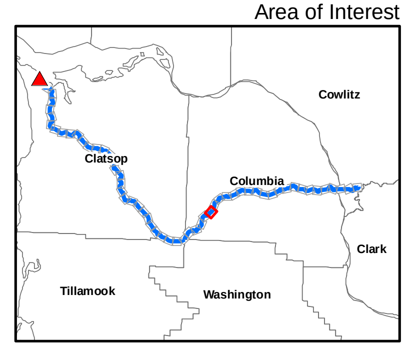
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



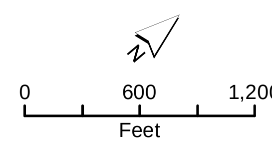


Figure 38
Aerial Maps of the Pipeline

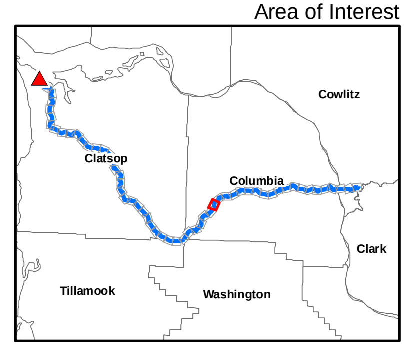
LEGEND

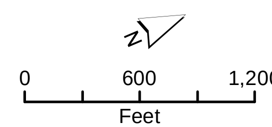
- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest





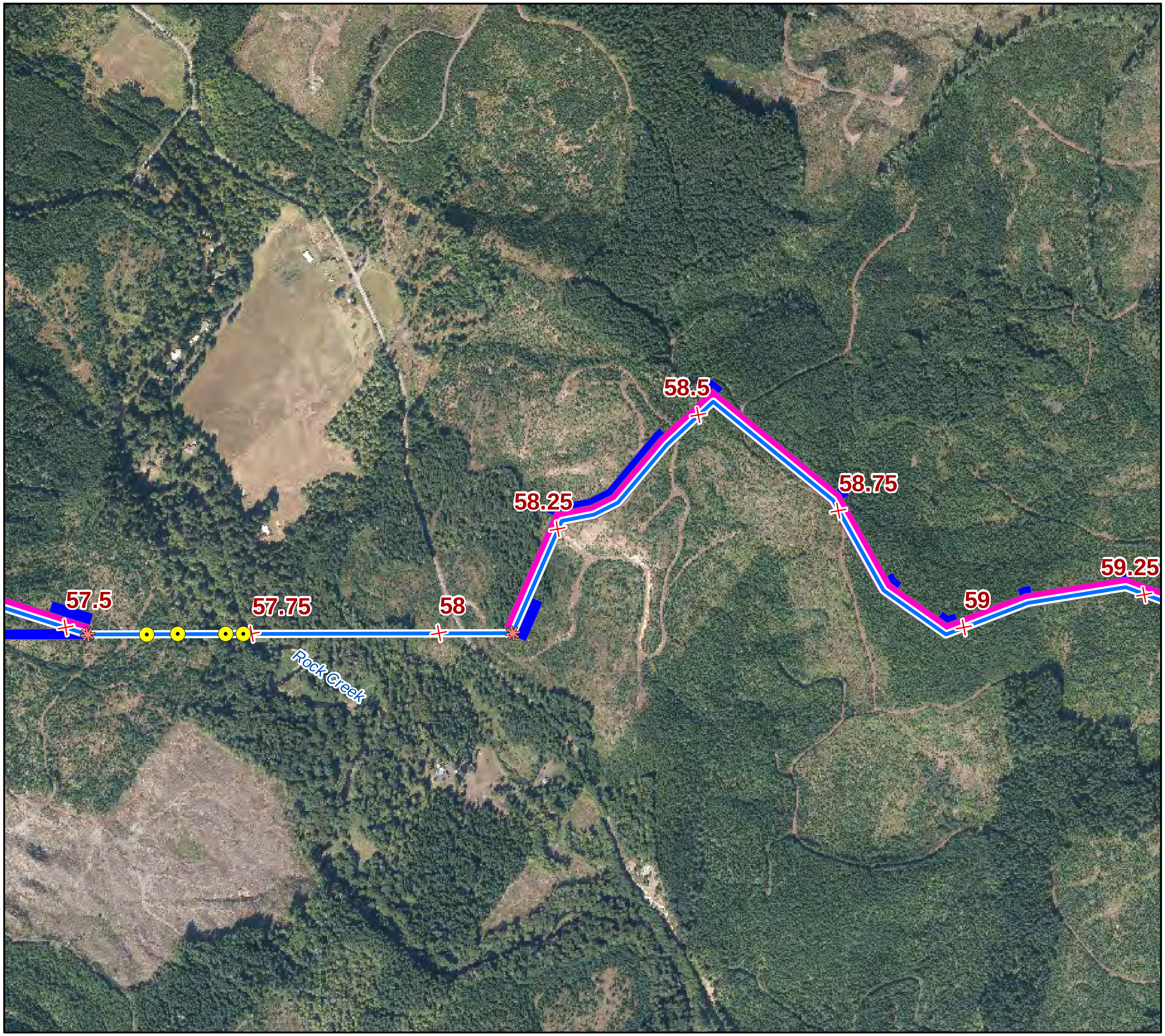


Figure 39
Aerial Maps of the Pipeline

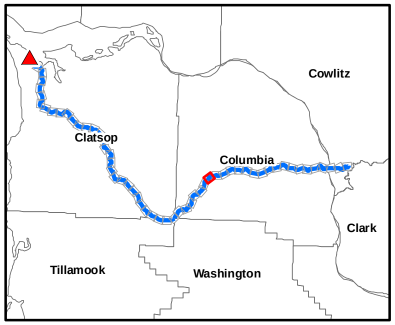
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



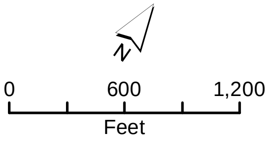


Figure 40
Aerial Maps of the Pipeline

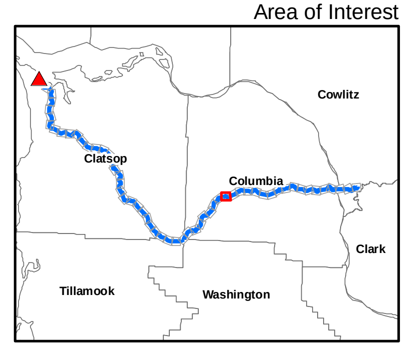
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



N

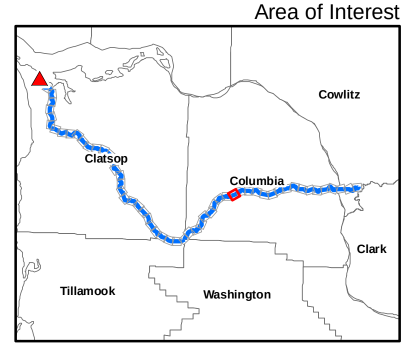
0 600 1,200
Feet

Figure 41
Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout
Pipeline Permanent, Temporary, and Additional Temporary Workspace
Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

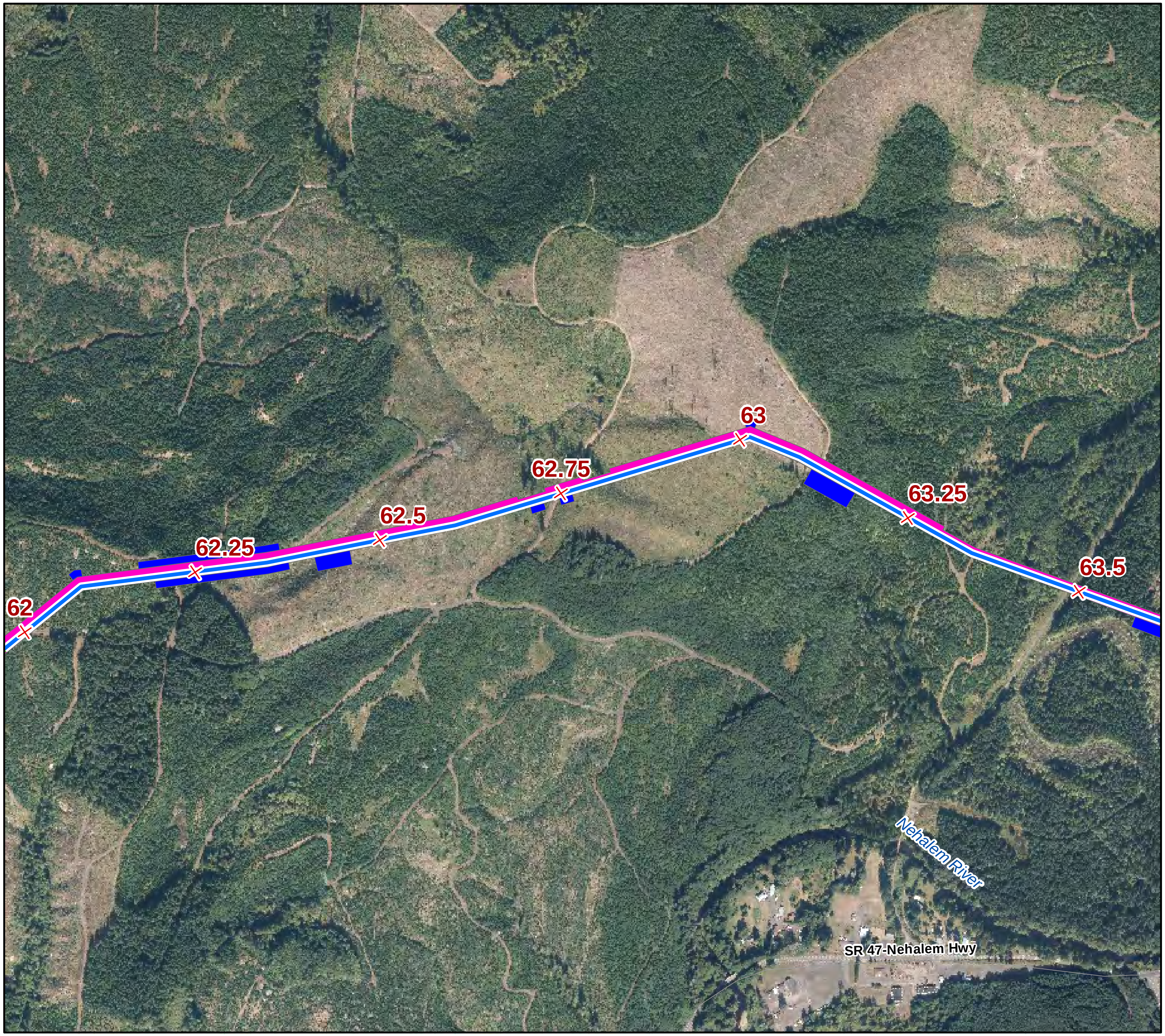


Figure 42
Aerial Maps of the Pipeline

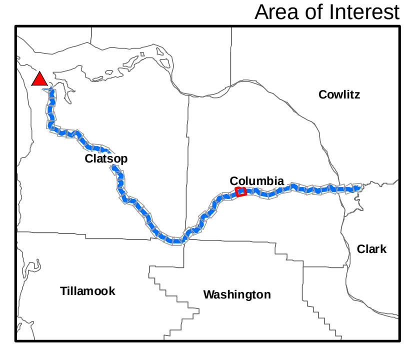
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

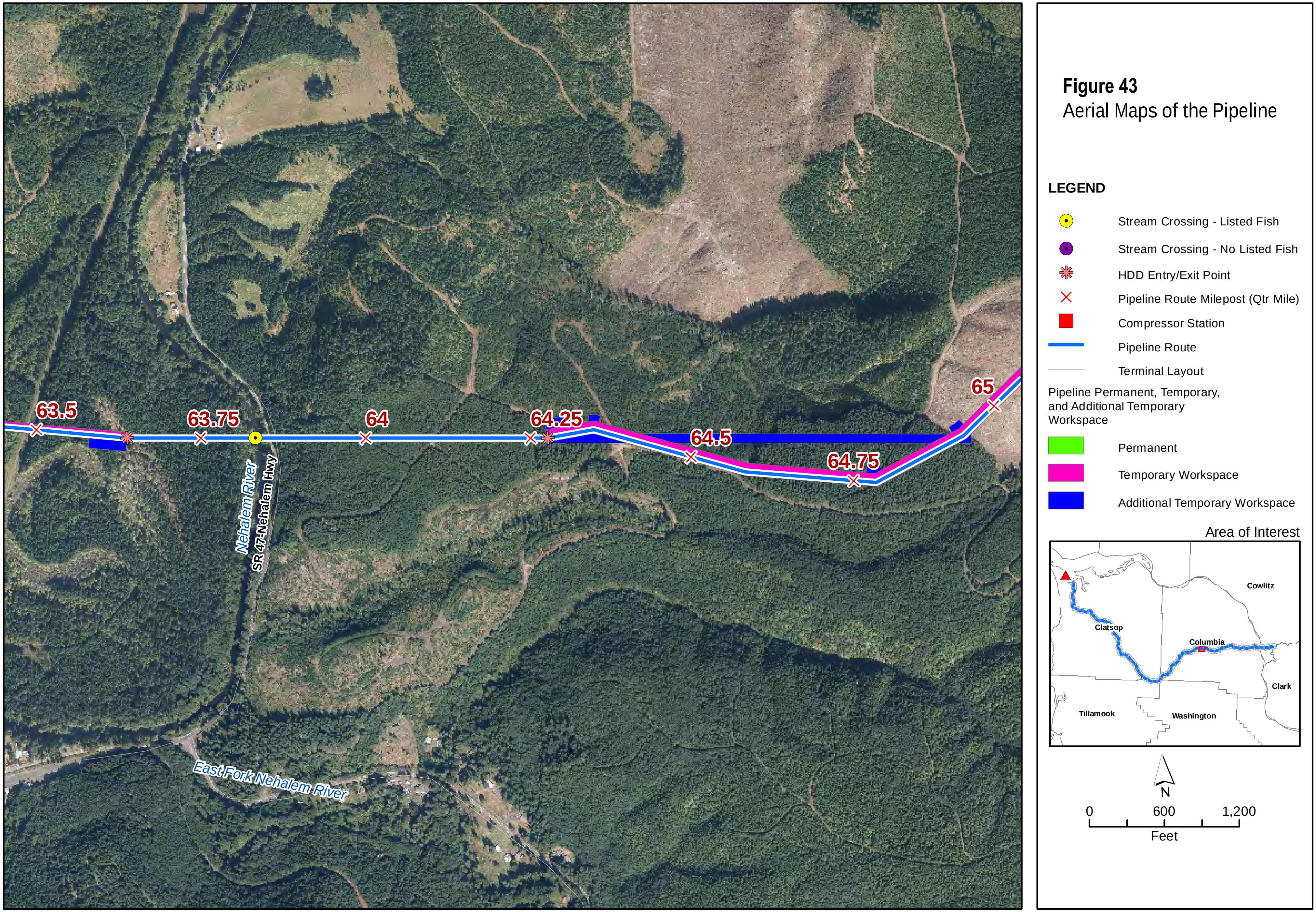
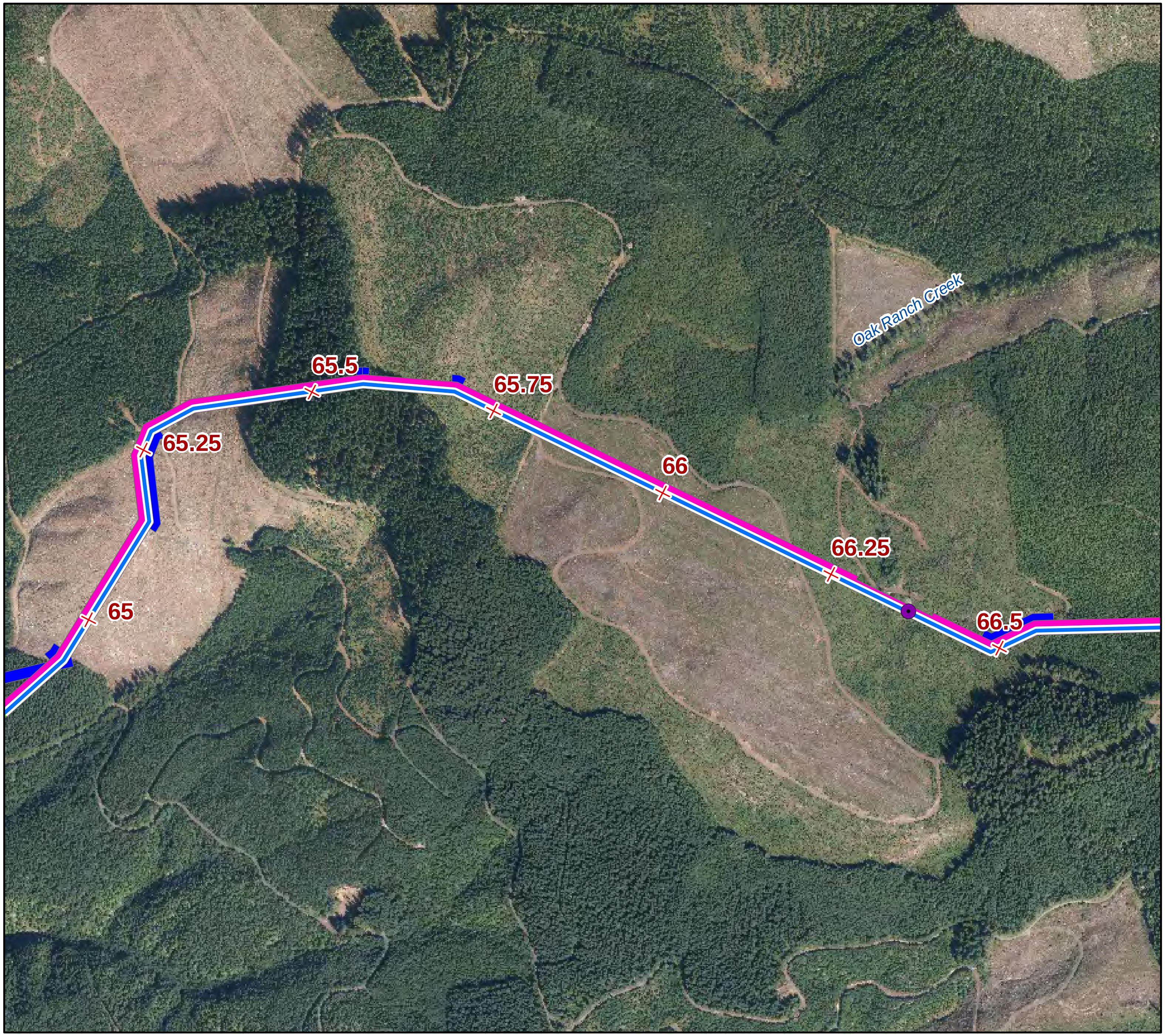

63.5
63.75
64
64.25
64.5
64.75
65
Nehalem River
SR 47-Nehalem Hwy
East Fork Nehalem River
Figure 43
Aerial Maps of the Pipeline
LEGEND
Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout
Pipeline Permanent, Temporary, and Additional Temporary Workspace
Permanent
Temporary Workspace
Additional Temporary Workspace
Area of Interest
Cowlitz
Clatsop
Columbia
Clark
Tillamook
Washington
N
0
600
1,200
Feet

Figure 44
Aerial Maps of the Pipeline



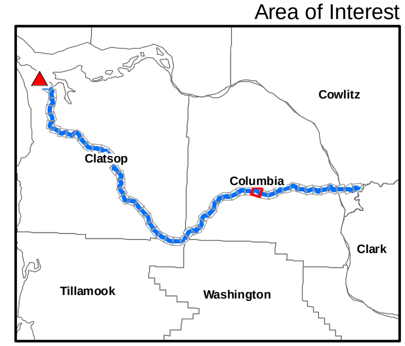
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200

Feet

Figure 45
Aerial Maps of the Pipeline

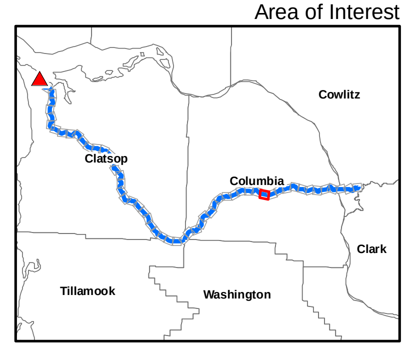
LEGEND

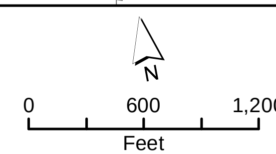
- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest





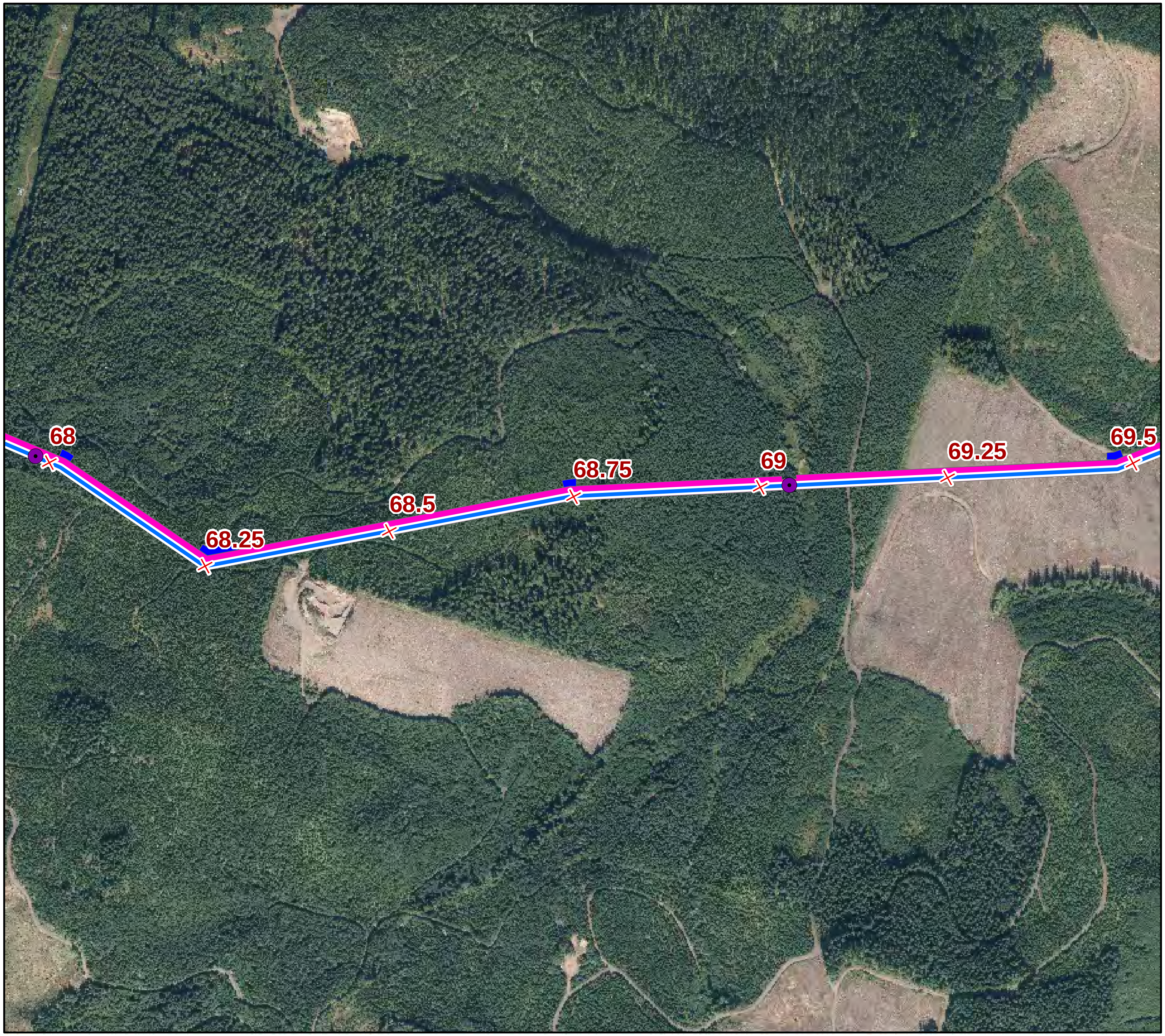


Figure 46
Aerial Maps of the Pipeline

LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest

Figure 47
Aerial Maps of the Pipeline

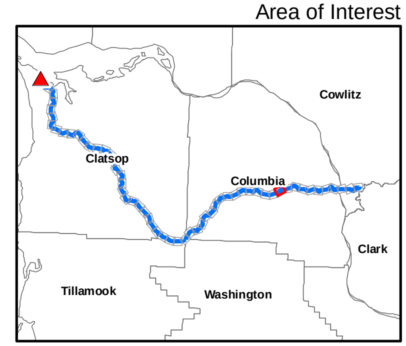
LEGEND

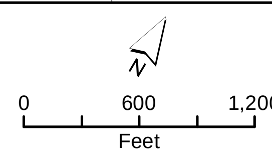
- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest





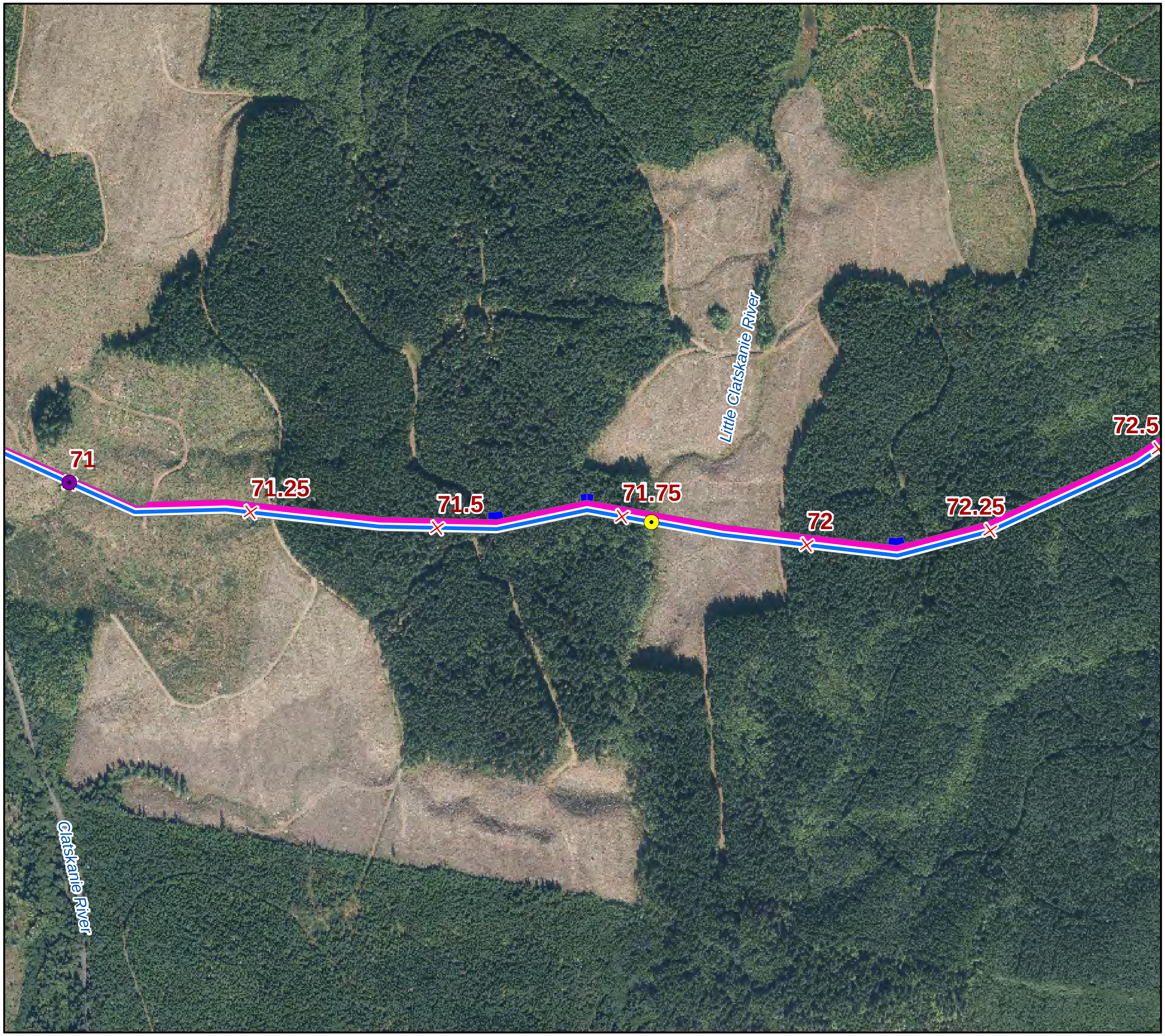


Figure 48
Aerial Maps of the Pipeline

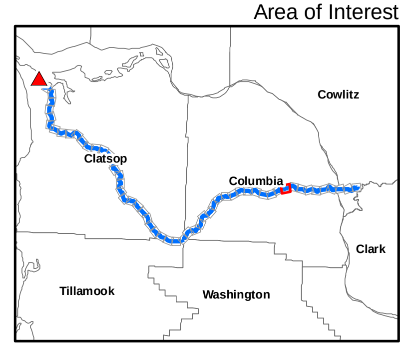
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

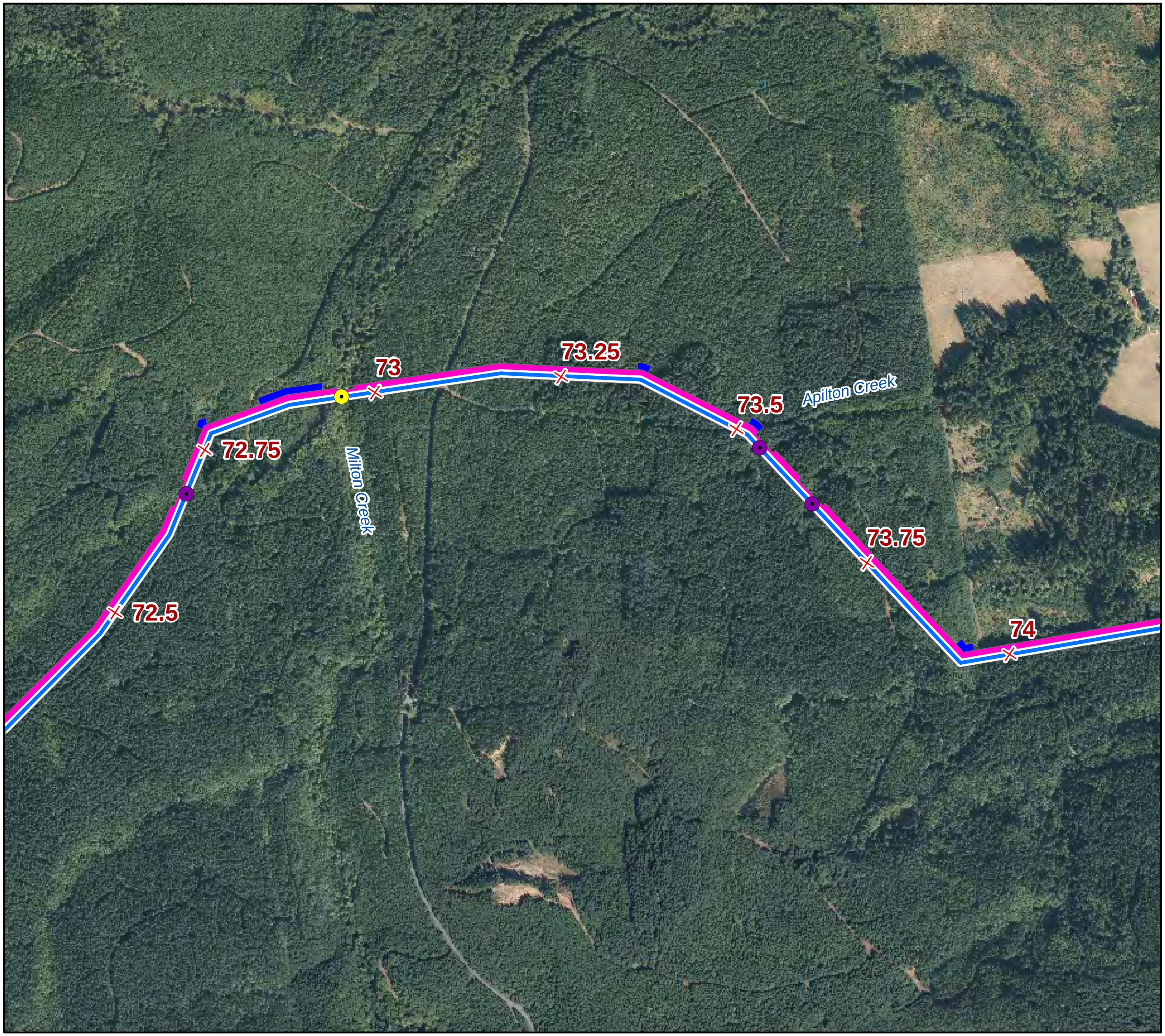


Figure 49
Aerial Maps of the Pipeline

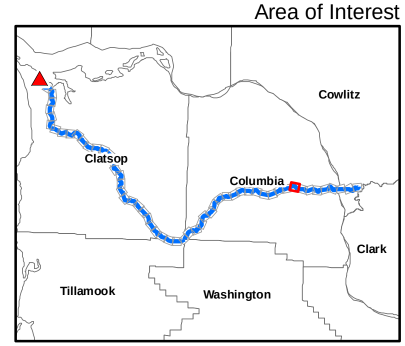
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

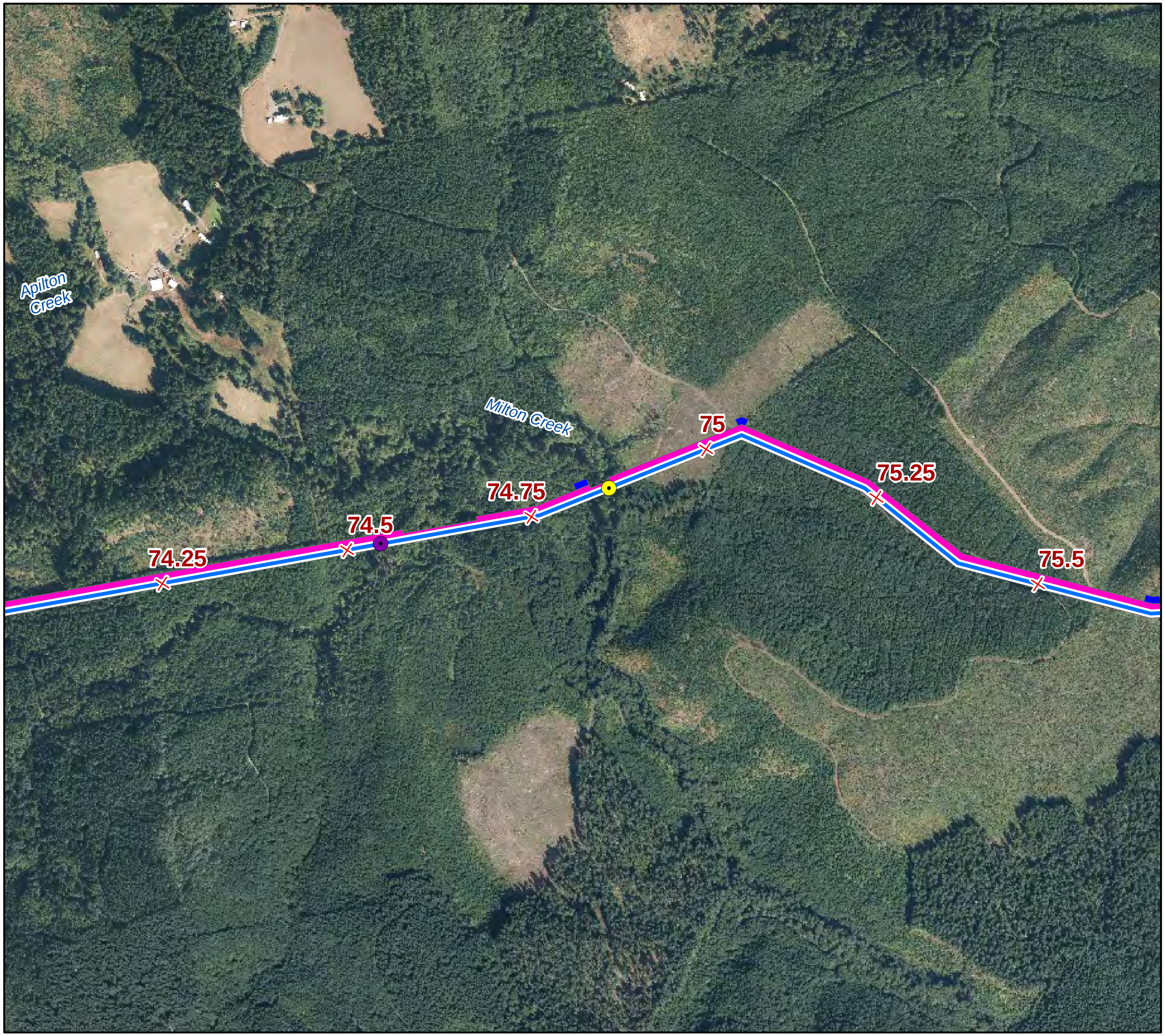


Figure 50
Aerial Maps of the Pipeline

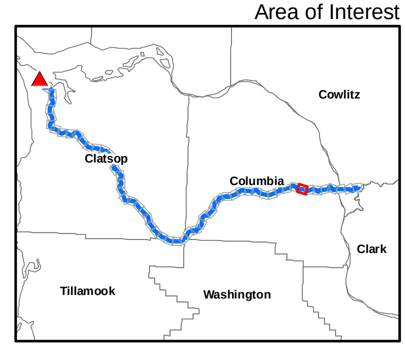
LEGEND

Stream Crossing - Listed Fish
Stream Crossing - No Listed Fish
HDD Entry/Exit Point
Pipeline Route Milepost (Qtr Mile)
Compressor Station
Pipeline Route
Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

Permanent
Temporary Workspace
Additional Temporary Workspace

Area of Interest



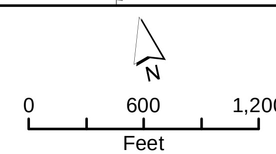


Figure 51
Aerial Maps of the Pipeline

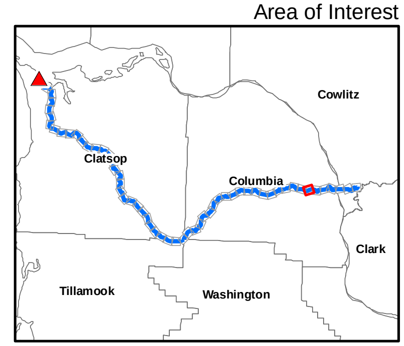
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

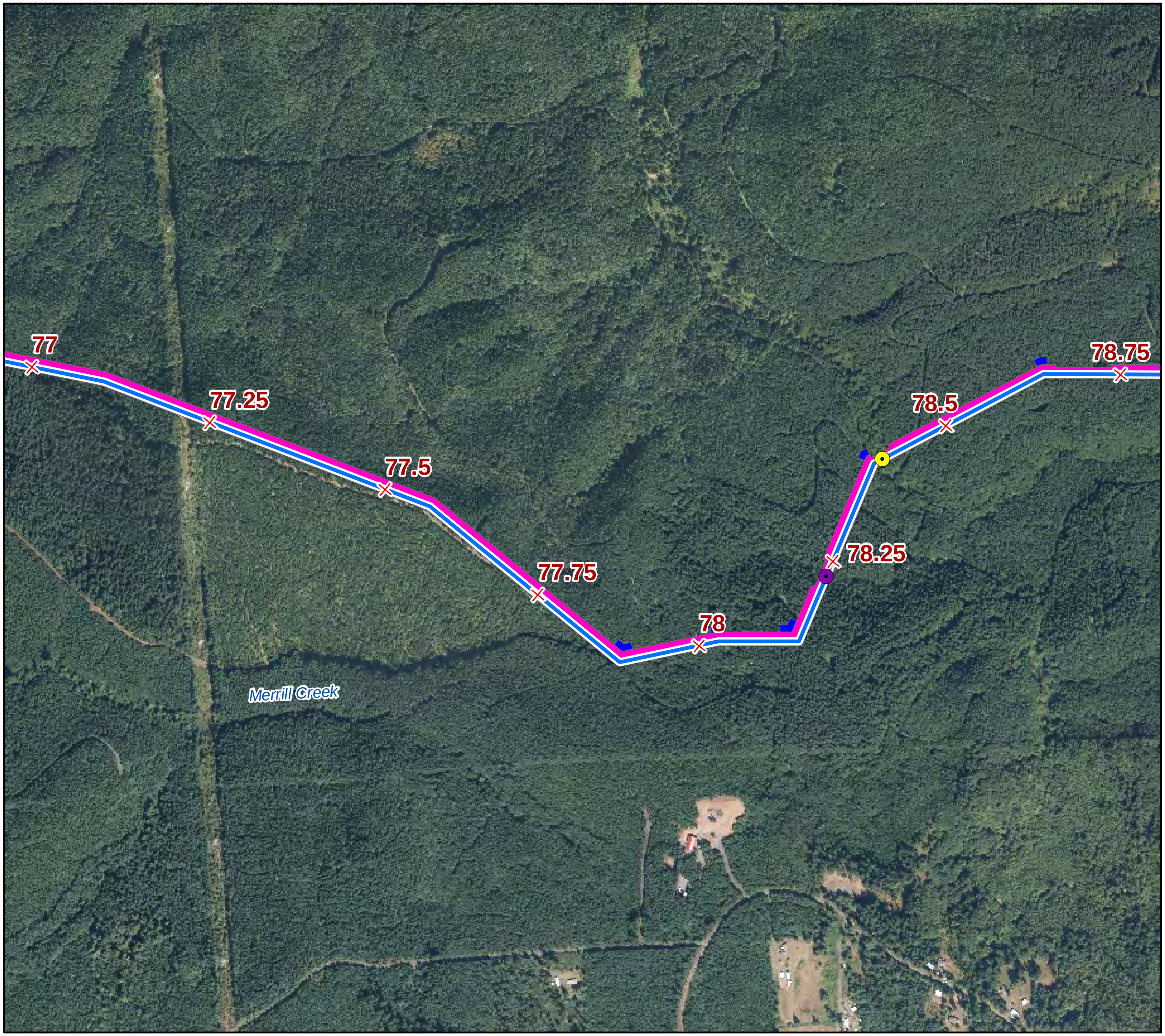


Figure 52
Aerial Maps of the Pipeline

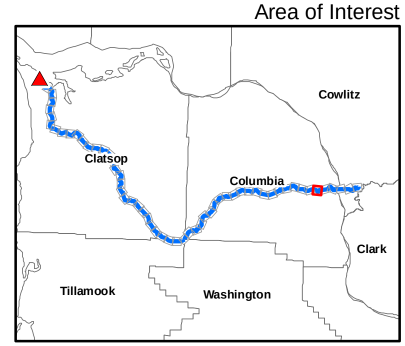
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 53
Aerial Maps of the Pipeline

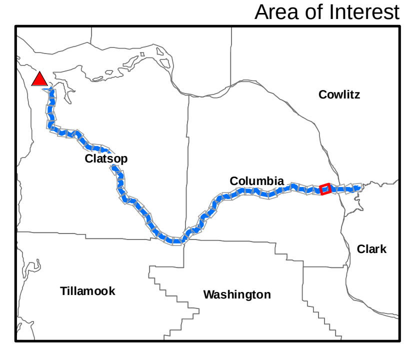
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



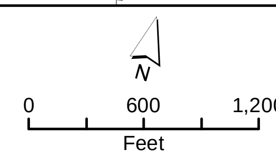


Figure 54
Aerial Maps of the Pipeline

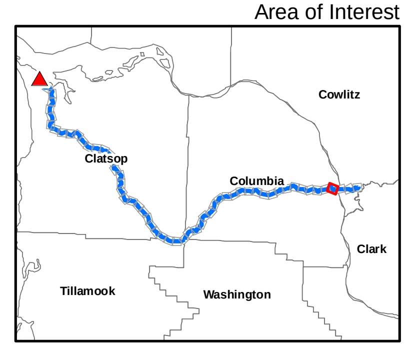
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 55
Aerial Maps of the Pipeline

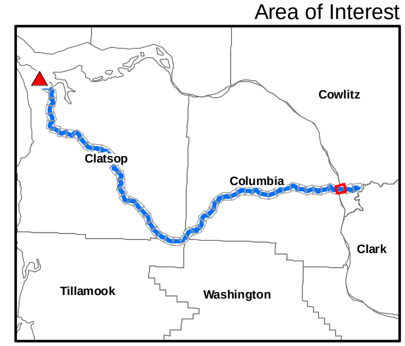
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

Figure 56
Aerial Maps of the Pipeline

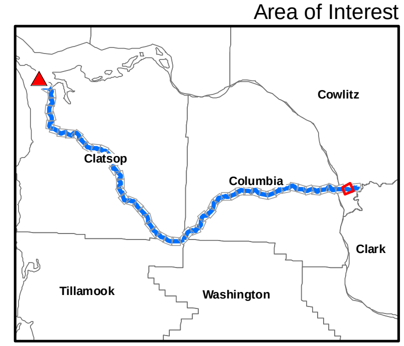
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



N

0 600 1,200
Feet

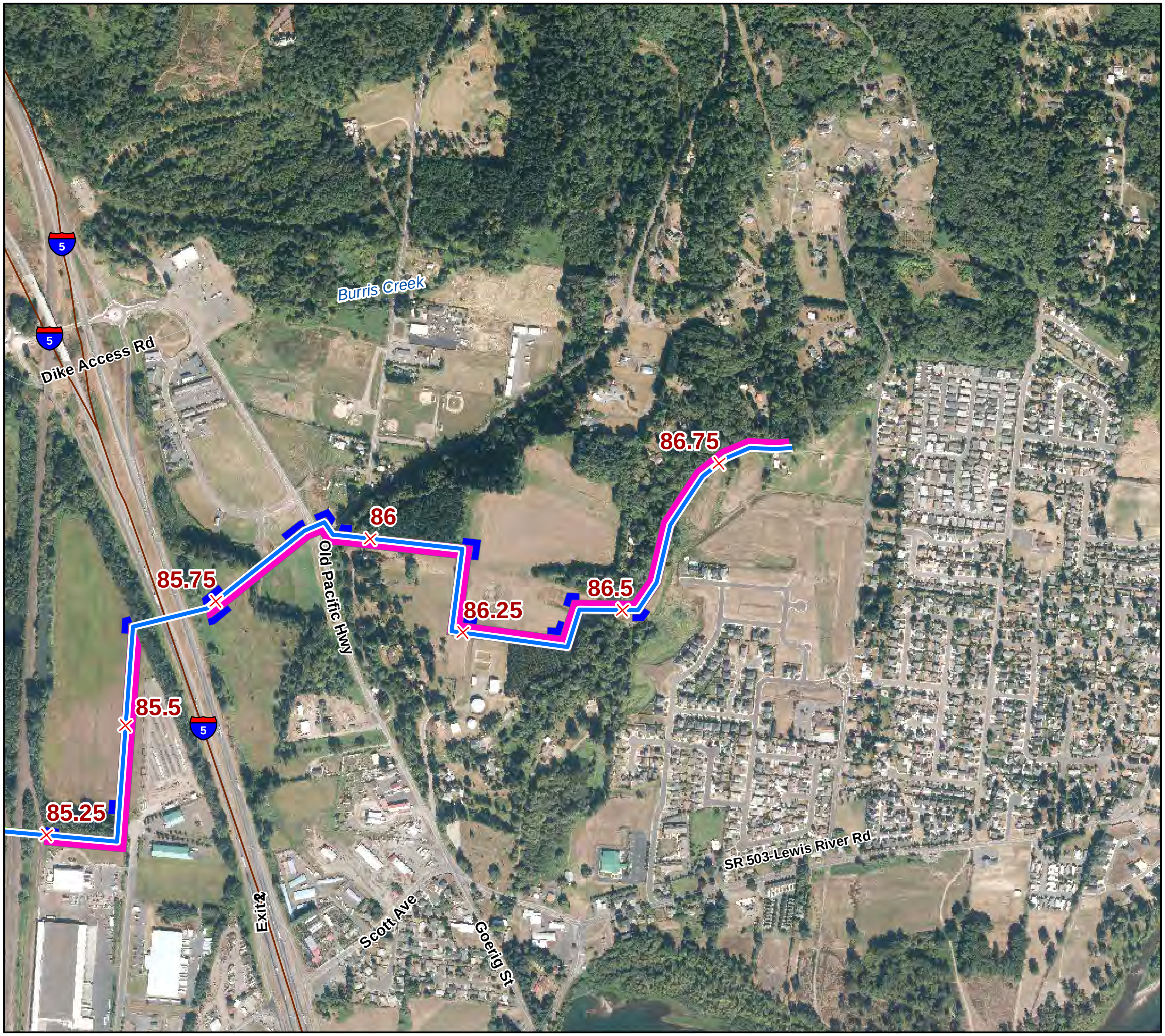


Figure 57
Aerial Maps of the Pipeline

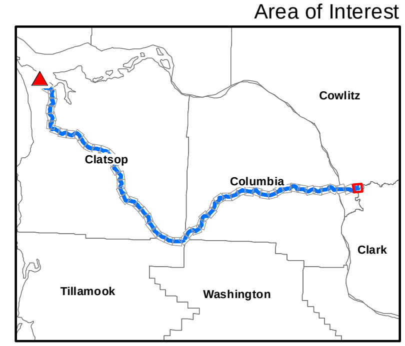
LEGEND

- Stream Crossing - Listed Fish
- Stream Crossing - No Listed Fish
- HDD Entry/Exit Point
- Pipeline Route Milepost (Qtr Mile)
- Compressor Station
- Pipeline Route
- Terminal Layout

Pipeline Permanent, Temporary, and Additional Temporary Workspace

- Permanent
- Temporary Workspace
- Additional Temporary Workspace

Area of Interest



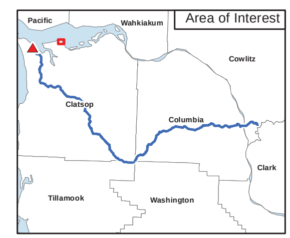
N

0 600 1,200
Feet

Figure 1
Construction Staging/Storage Areas

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- Staging Area
- Parcels



N

0 500 1,000
Feet

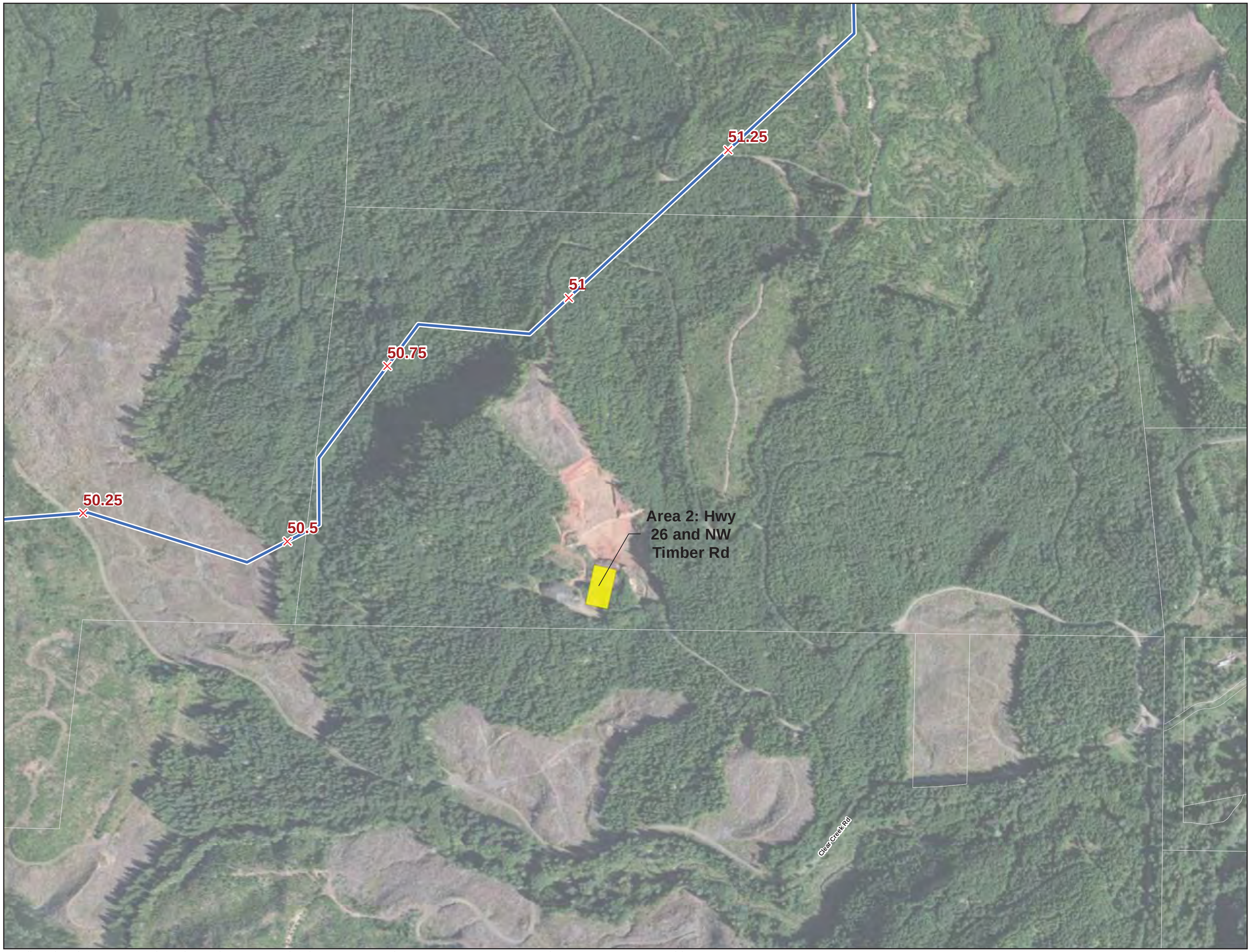
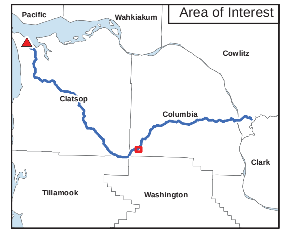


Figure 2 Construction Staging/Storage Areas

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- Staging Area
- Parcels



N

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Feet

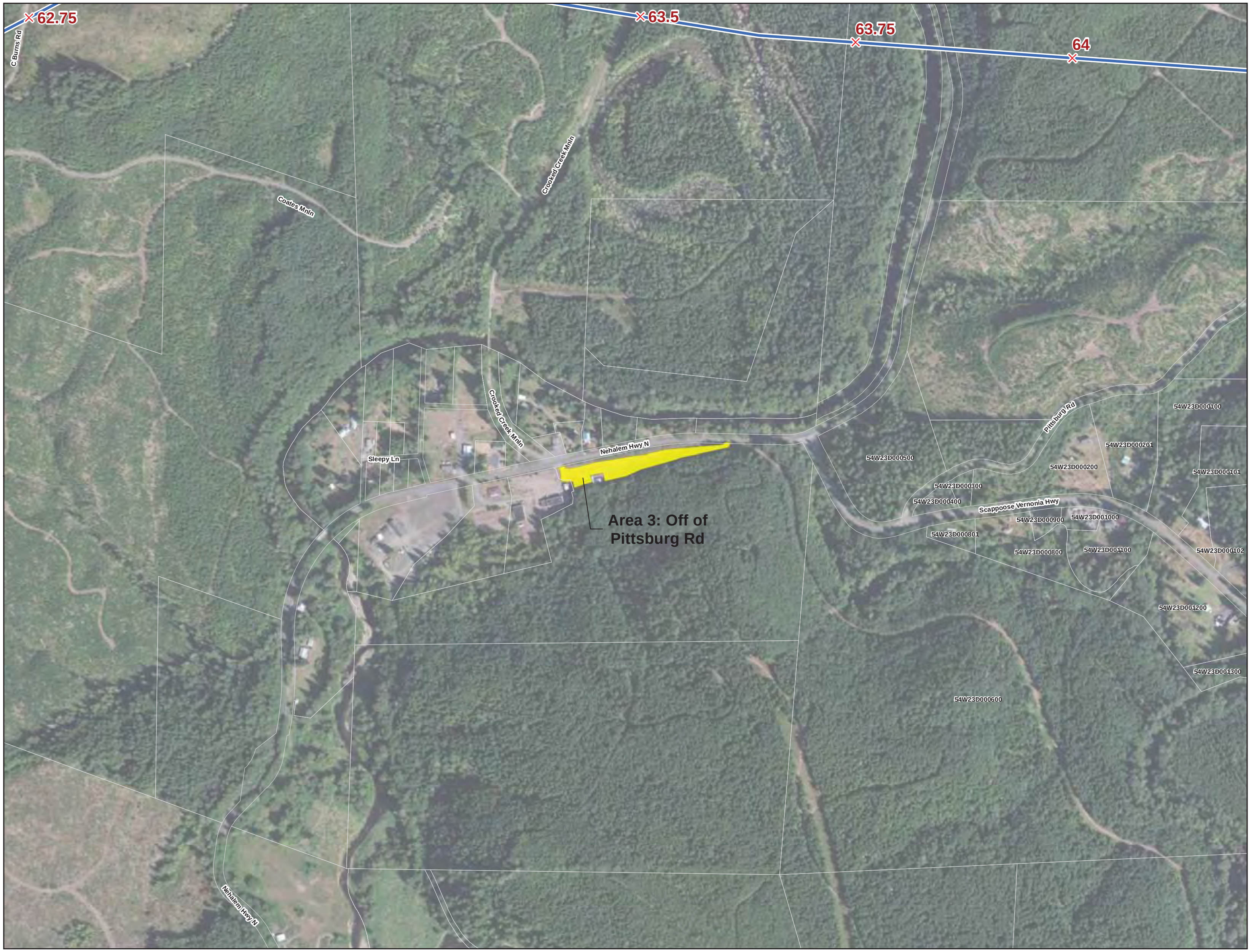
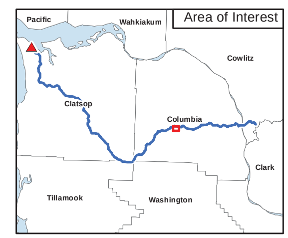


Figure 3 Construction Staging/Storage Areas

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- Staging Area
- Parcels



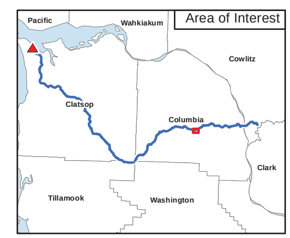
N

0 500 1,000
Feet

Figure 4 Construction Staging/Storage Areas

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- Staging Area
- Parcels



N

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Feet

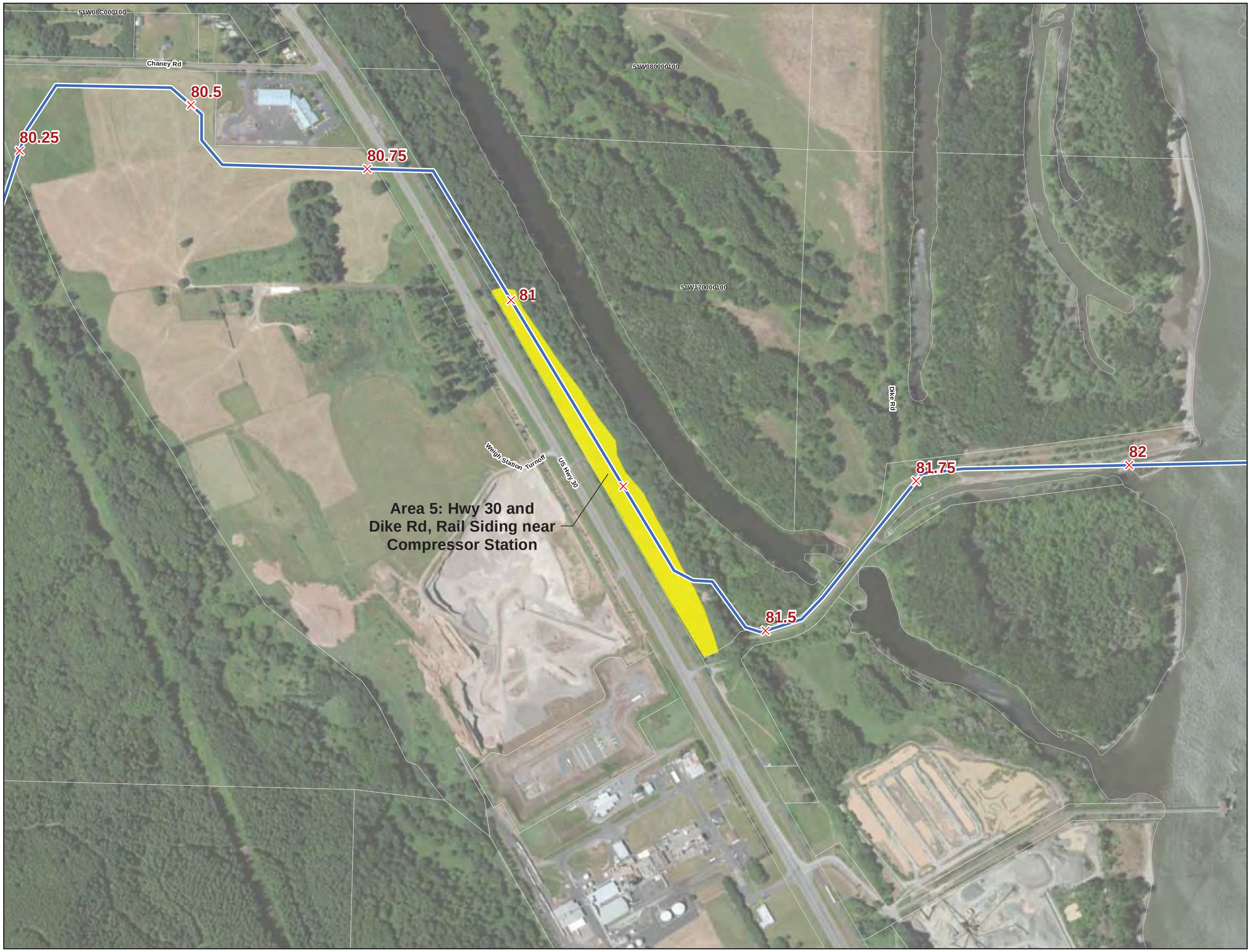
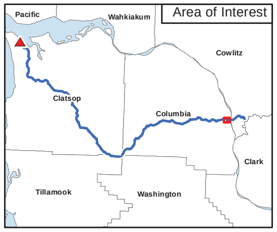


Figure 5 Construction Staging/Storage Areas

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- Staging Area
- Parcels



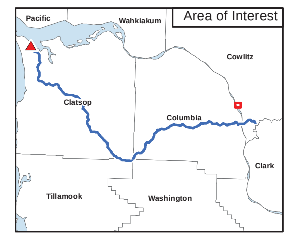
N

0 500 1,000
Feet

Figure 6 Construction Staging/Storage Areas

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- Staging Area
- Parcels



N

0 500 1,000
Feet

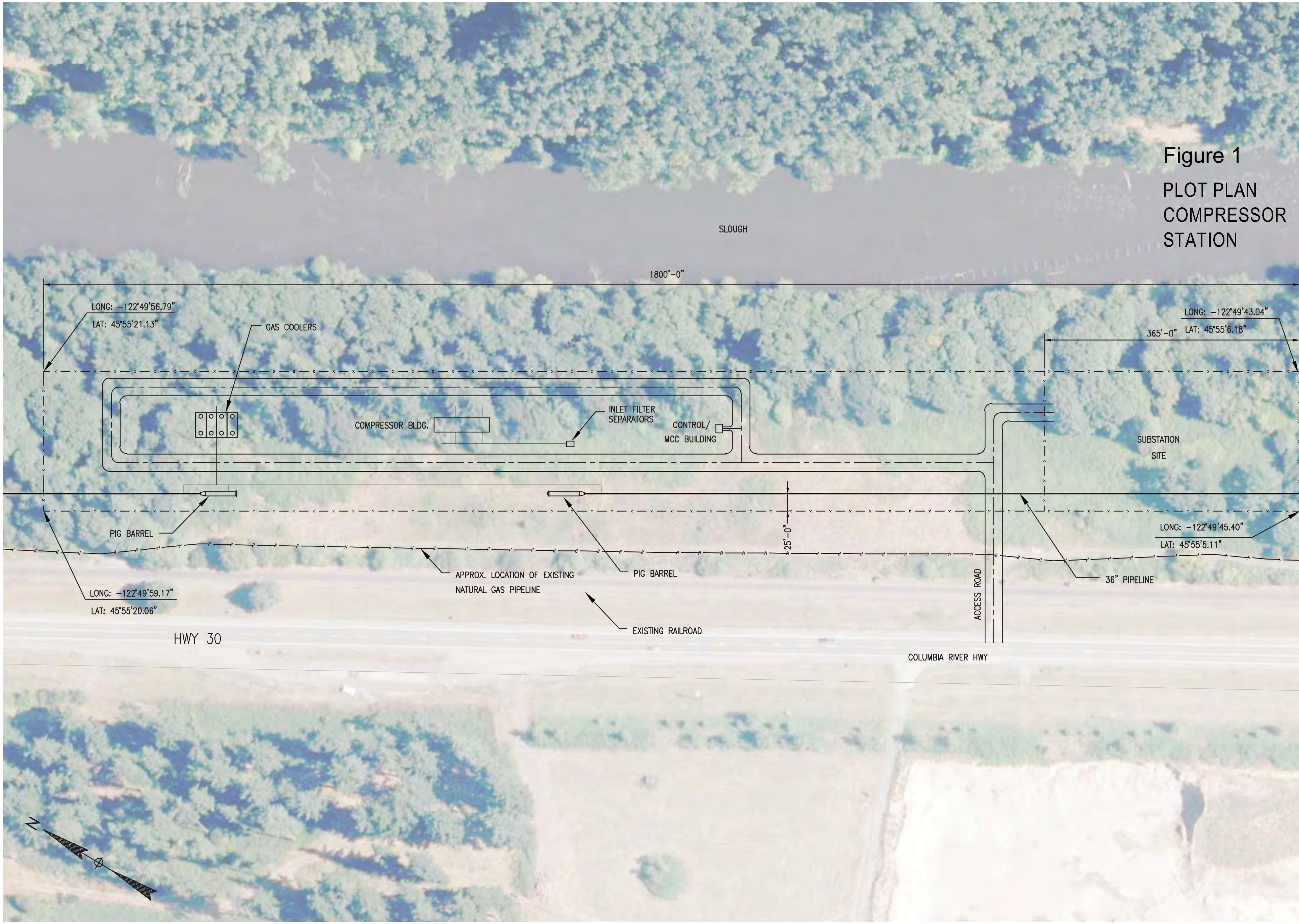


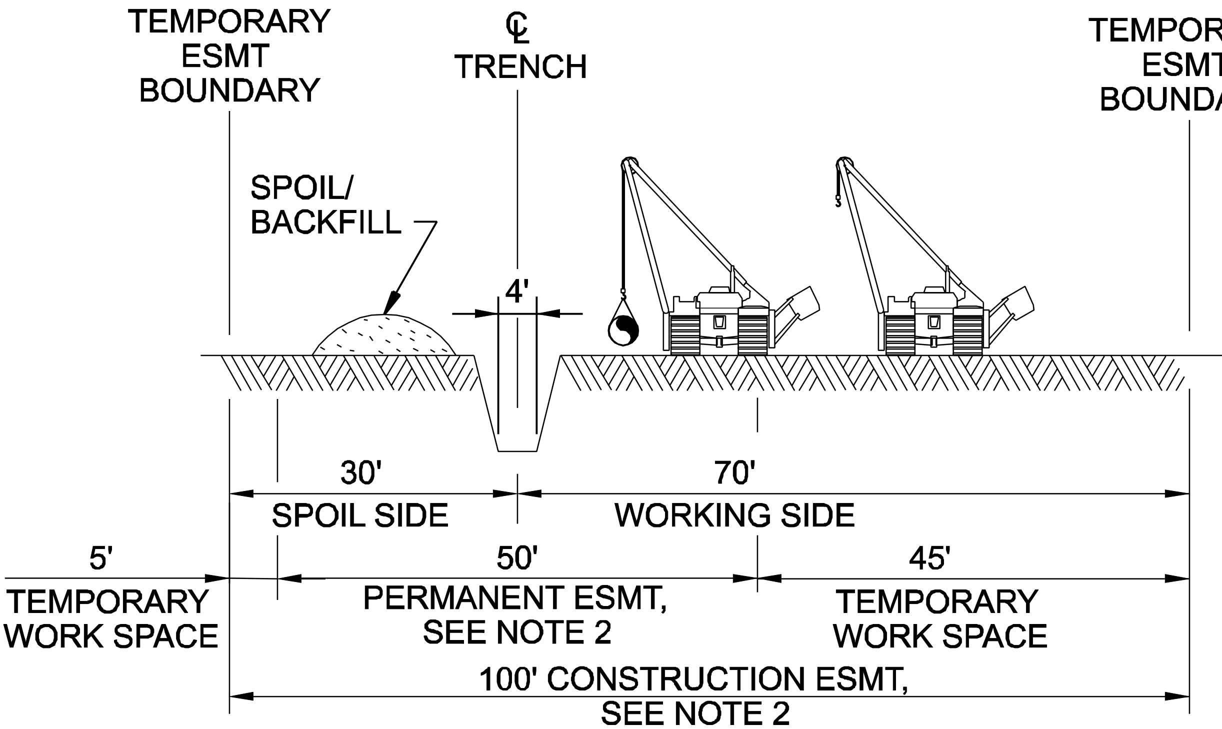
Figure 1
PLOT PLAN
COMPRESSOR
STATION
SLOUGH
1800'-0"
LONG: -122°49'56.79"
LAT: 45°55'21.13"
GAS COOLERS
COMPRESSOR BLDG.
INLET FILTER
SEPARATORS
CONTROL/
MCC BUILDING
LONG: -122°49'43.04"
LAT: 45°55'6.18"
365'-0"
SUBSTATION
SITE
200'-0"
PIG BARREL
25'-0"
LONG: -122°49'45.40"
LAT: 45°55'5.11"
APPROX. LOCATION OF EXISTING
NATURAL GAS PIPELINE
PIG BARREL
36" PIPELINE
ACCESS ROAD
LONG: -122°49'59.17"
LAT: 45°55'20.06"
HWY 30
EXISTING RAILROAD
COLUMBIA RIVER HWY
N

APPENDIX E2

PIPELINE CONSTRUCTION RIGHT-OF-WAY CROSS SECTIONS

1 EASEMENT DETAIL

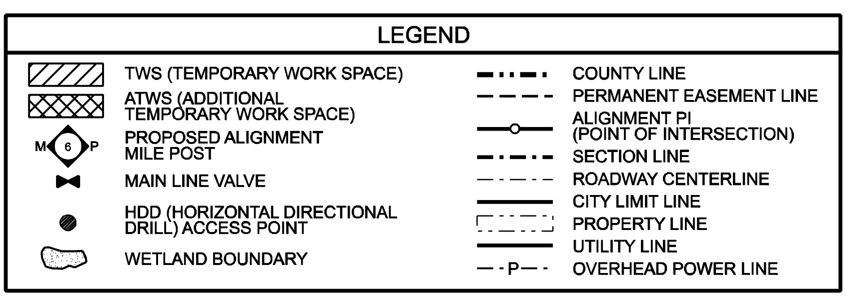
1"=20'-0"



NOTES:

1. EASEMENT CONFIGURATION UTILIZED WHEN CONSTRUCTING ACROSS A GREENFIELD AREA WHERE IDENTIFIED ON THE CONSTRUCTION DRAWINGS.

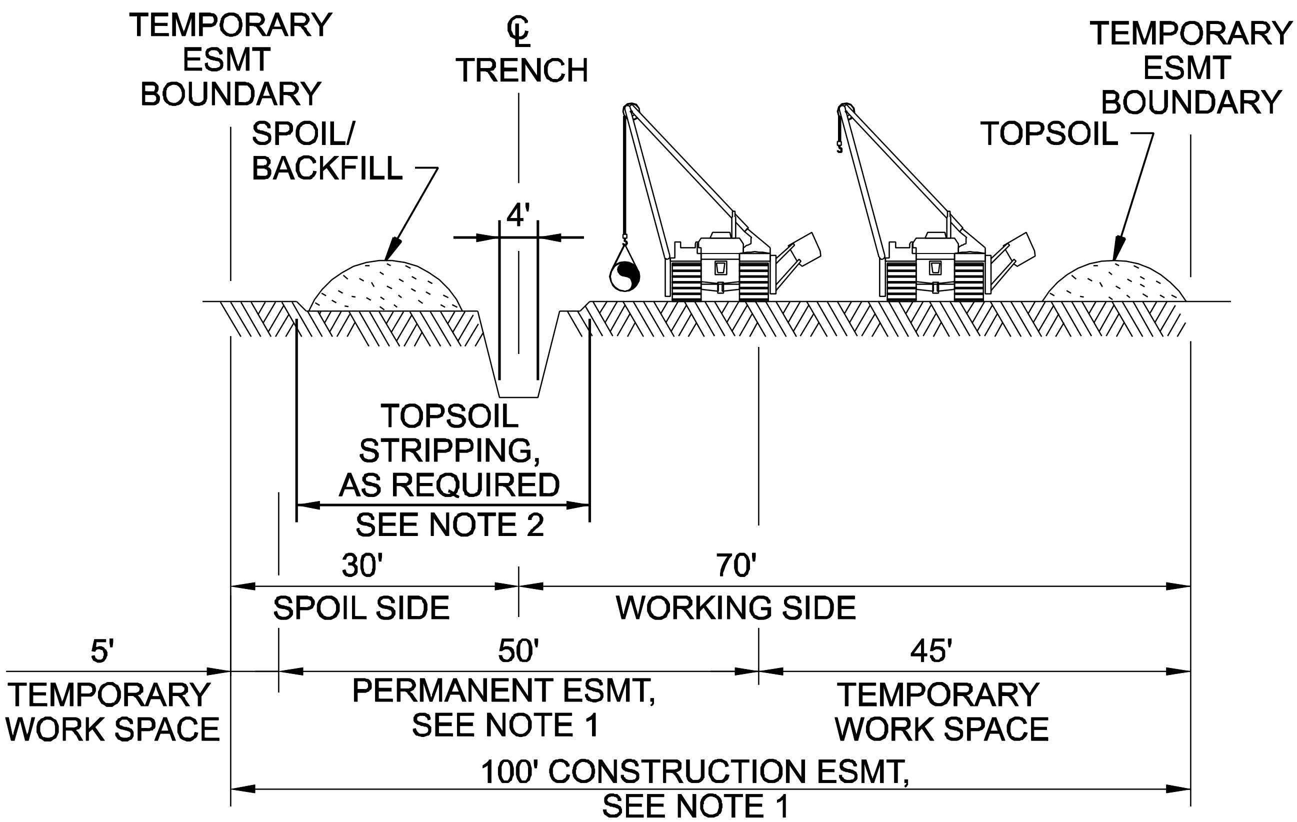
2. CONSTRUCTION EASEMENT WILL TYPICALLY BE 100' WIDE, CONSISTING OF A 50' PERMANENT EASEMENT, AND 50' OF TEMPORARY WORK SPACE. EXTRA TEMPORARY WORK SPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.



EASEMENT WITH TOPSOIL SEGREGATION DETAIL

2

1"=20'-0"



NOTES:

1. CONSTRUCTION EASEMENT WILL TYPICALLY BE 100' WIDE, CONSISTING OF A 50' PERMANENT EASEMENT, AND 50' OF TEMPORARY WORK SPACE. EXTRA TEMPORARY WORK SPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.

2. THIS DRAWING REFLECTS "TRENCH AND SPOIL SIDE" TOPSOIL STRIPPING PROCEDURE. SALVAGE TOPSOIL OVER TRENCH AND UNDER THE SPOIL PILE AT LOCATIONS IDENTIFIED ON THE CONSTRUCTION ALIGNMENT SHEETS, OR AS DIRECTED BY THE COMPANY'S INSPECTOR. DEPTH OF TOPSOIL STRIPPING IS NOT TO EXCEED 12". MINIMUM WIDTH OF TOPSOIL STRIPPING ON THE WORKING SIDE OF THE TRENCH IS 12".

3. STOCKPILE TOPSOIL AS SHOWN OR IN ANY CONFIGURATION APPROVED BY THE COMPANY'S INSPECTOR. KEEP TOPSOIL CLEAN OF ALL CONSTRUCTION DEBRIS. MAINTAIN A MINIMUM 12" OF SEPARATION BETWEEN TOPSOIL AND SUBSOIL PILES.

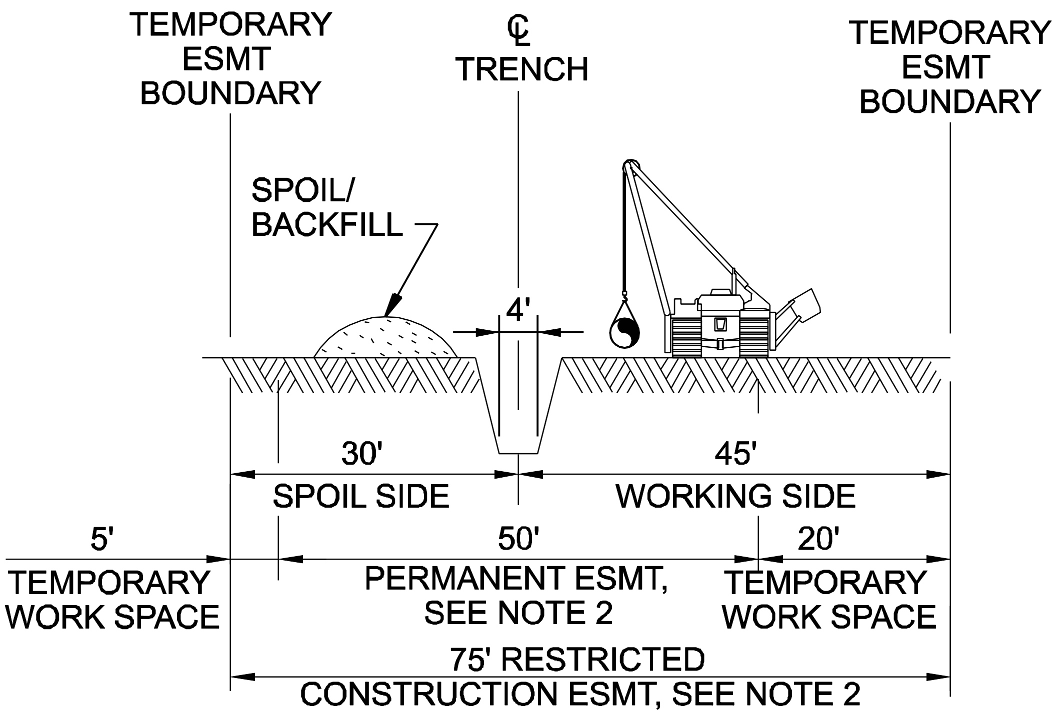
LEGEND

TWS (TEMPORARY WORK SPACE)	COUNTY LINE
ATWS (ADDITIONAL TEMPORARY WORK SPACE)	PERMANENT EASEMENT LINE
M 6 P PROPOSED ALIGNMENT MILE POST	ALIGNMENT PI (POINT OF INTERSECTION)
MAIN LINE VALVE	SECTION LINE
HDD (HORIZONTAL DIRECTIONAL DRILL) ACCESS POINT	ROADWAY CENTERLINE
WETLAND BOUNDARY	CITY LIMIT LINE
	PROPERTY LINE
	UTILITY LINE
	—P— OVERHEAD POWER LINE

RESTRICTED EASEMENT FOR WETLAND DETAIL

3

1"=20'-0"



NOTES:

1. EASEMENT CONFIGURATION UTILIZED WHEN CONSTRUCTING ACROSS A WETLAND IN A GREENFIELD AREA WHERE IDENTIFIED ON THE CONSTRUCTION DRAWINGS.

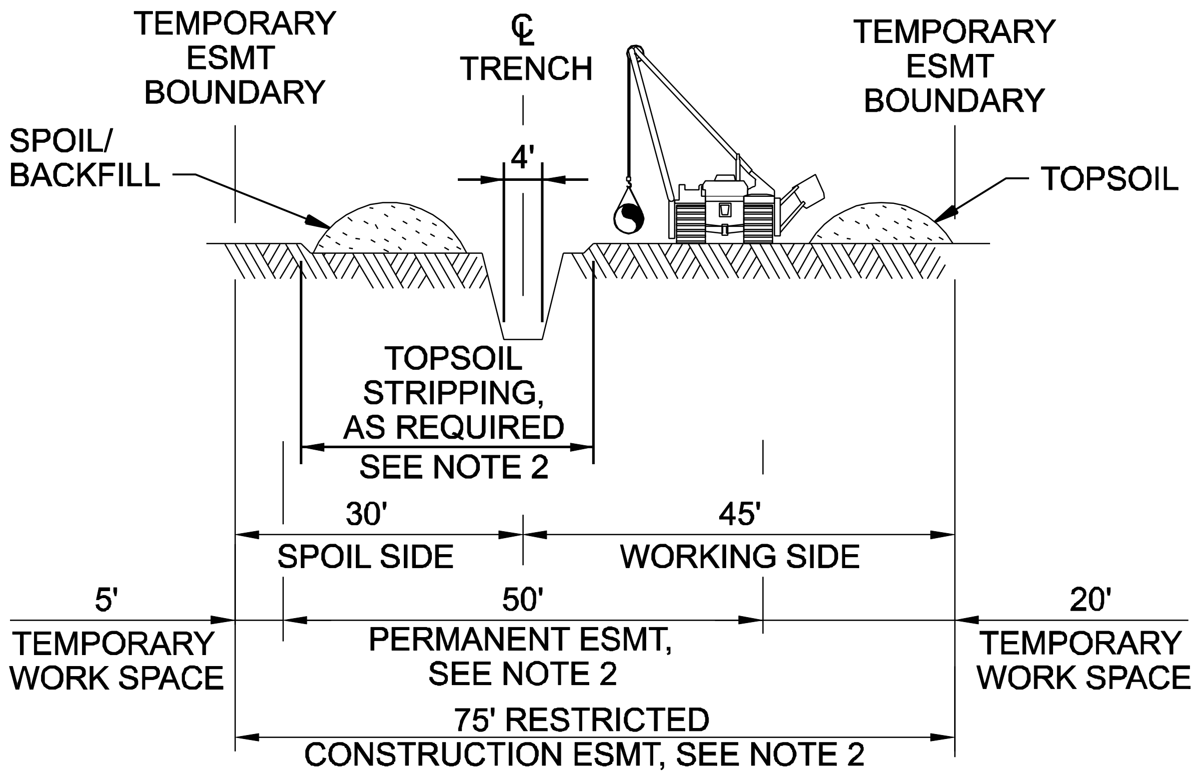
2. CONSTRUCTION EASEMENT WILL TYPICALLY BE 75' WIDE, CONSISTING OF A 50' PERMANENT EASEMENT, AND 25' OF TEMPORARY WORK SPACE. EXTRA TEMPORARY WORK SPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED.

LEGEND	
TWS (TEMPORARY WORK SPACE)	COUNTY LINE
ATWS (ADDITIONAL TEMPORARY WORK SPACE)	PERMANENT EASEMENT LINE
PROPOSED ALIGNMENT MILE POST	ALIGNMENT PI (POINT OF INTERSECTION)
MAIN LINE VALVE	SECTION LINE
HDD (HORIZONTAL DIRECTIONAL DRILL) ACCESS POINT	ROADWAY CENTERLINE
WETLAND BOUNDARY	CITY LIMIT LINE
	PROPERTY LINE
	UTILITY LINE
	OVERHEAD POWER LINE

RESTRICTED EASEMENT WITH TOPSOIL SEGREGATION DETAIL

4

1"=20'-0"

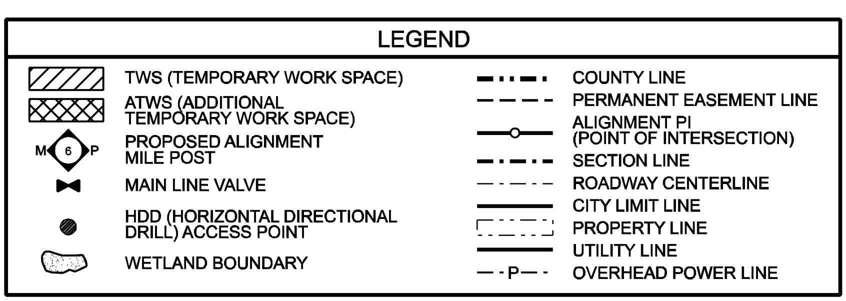


NOTES:

1. CONSTRUCTION EASEMENT WILL TYPICALLY BE 75' WIDE, CONSISTING OF A 50' PERMANENT EASEMENT, AND 25' OF TEMPORARY WORK SPACE. EXTRA TEMPORARY WORK SPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.

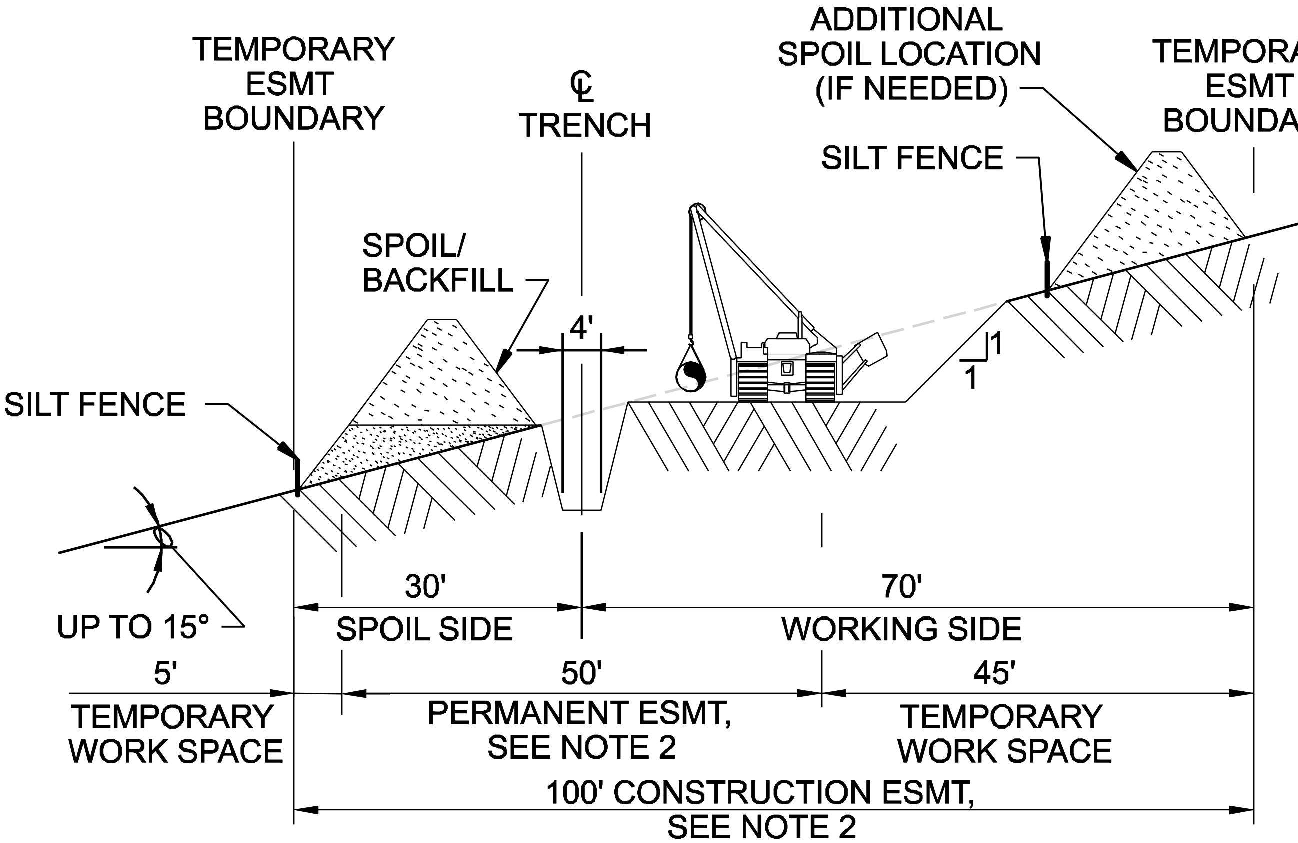
2. THIS DRAWING REFLECTS "TRENCH AND SPOIL SIDE" TOPSOIL STRIPPING PROCEDURE. SALVAGE TOPSOIL OVER TRENCH AND UNDER THE SPOIL PILE AT LOCATIONS IDENTIFIED ON THE CONSTRUCTION ALIGNMENT SHEETS, OR AS DIRECTED BY THE COMPANY'S INSPECTOR. DEPTH OF TOPSOIL STRIPPING IS NOT TO EXCEED 12". MINIMUM WIDTH OF TOPSOIL STRIPPING ON THE WORKING SIDE OF THE TRENCH IS 12".

3. STOCKPILE TOPSOIL AS SHOWN OR IN ANY CONFIGURATION APPROVED BY THE COMPANY'S INSPECTOR. KEEP TOPSOIL CLEAN OF ALL CONSTRUCTION DEBRIS. MAINTAIN A MINIMUM 12" OF SEPARATION BETWEEN TOPSOIL AND SUBSOIL PILES.



5 EASEMENT FOR SIDE HILL CONSTRUCTION DETAIL

1"=20'-0"



NOTES:

1. SIDE HILL CONSTRUCTION CUT AND FILL SHALL BE ALLOWED WHENEVER, IN THE OPINION OF THE CONTRACTOR, STEEP SIDE HILL CONSTRUCTION IS WARRANTED FOR PERSONAL AND/OR EQUIPMENT SAFETY CONSIDERATIONS.

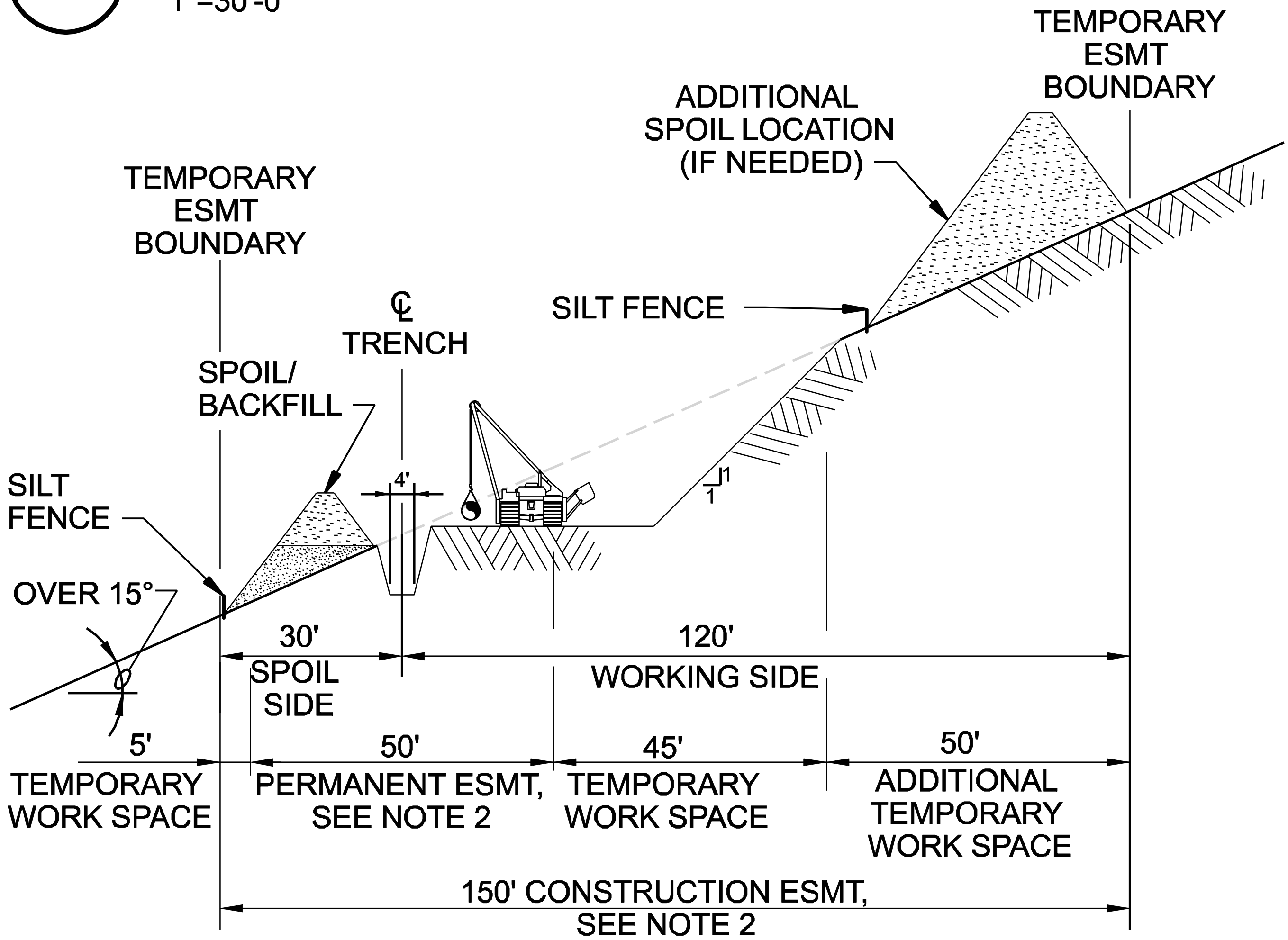
2. CONSTRUCTION EASEMENT WILL TYPICALLY BE 100' WIDE, CONSISTING OF A 50' PERMANENT EASEMENT AND A 50' OF TEMPORARY WORK SPACE. EXTRA TEMPORARY WORK SPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.

LEGEND

TWS (TEMPORARY WORK SPACE)	COUNTY LINE
ATWS (ADDITIONAL TEMPORARY WORK SPACE)	PERMANENT EASEMENT LINE
M 6 P PROPOSED ALIGNMENT MILE POST	ALIGNMENT PI (POINT OF INTERSECTION)
MAIN LINE VALVE	SECTION LINE
HDD (HORIZONTAL DIRECTIONAL DRILL) ACCESS POINT	ROADWAY CENTERLINE
WETLAND BOUNDARY	CITY LIMIT LINE
	PROPERTY LINE
	UTILITY LINE
	— - P— - OVERHEAD POWER LINE

6 EASEMENT FOR SEVERE SIDE HILL CONSTRUCTION DETAIL

1"=30'-0"



NOTES:

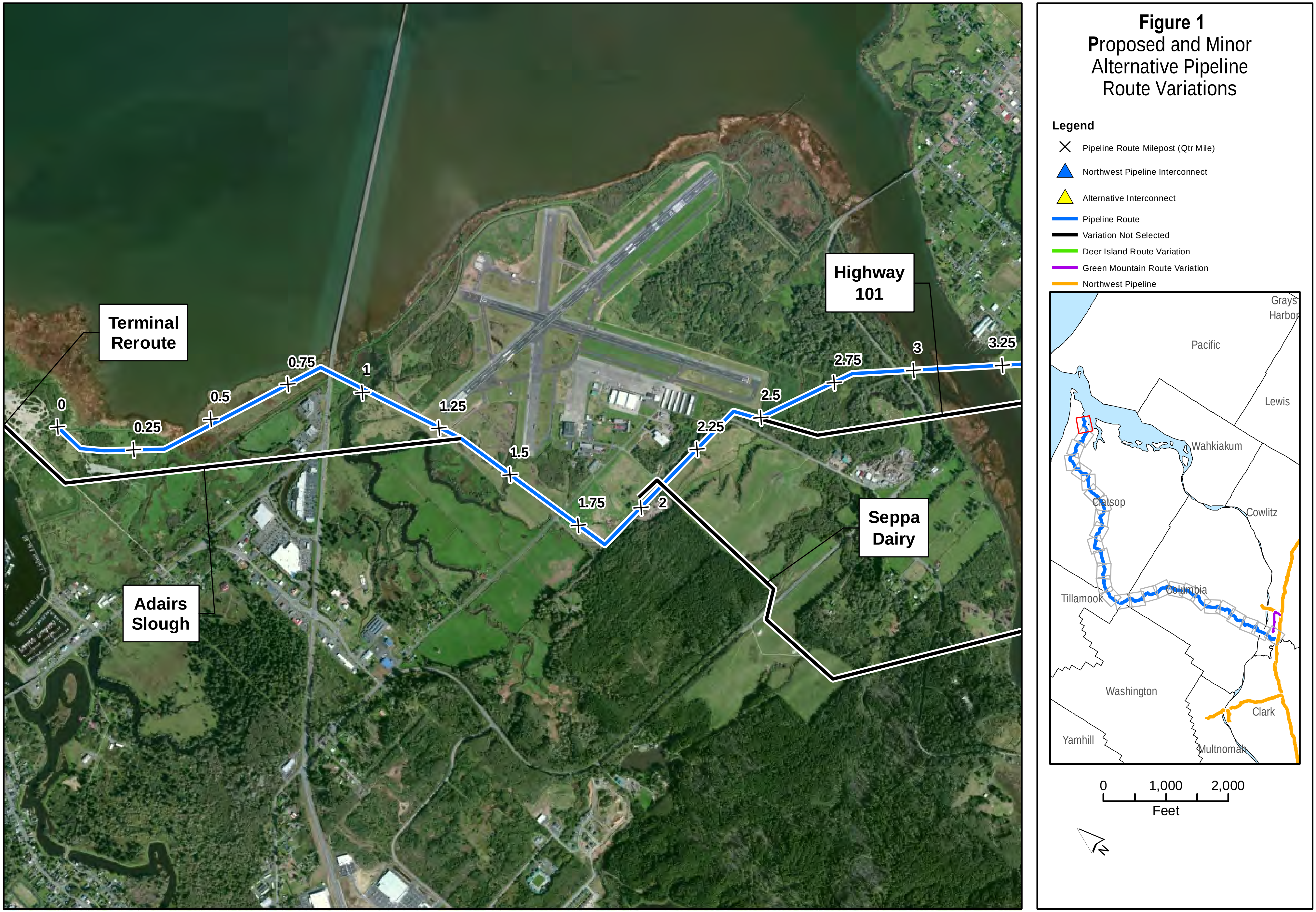
1. SIDE HILL CONSTRUCTION CUT AND FILL SHALL BE ALLOWED WHENEVER, IN THE OPINION OF THE CONTRACTOR, STEEP SIDE HILL CONSTRUCTION IS WARRANTED FOR PERSONAL AND/OR EQUIPMENT SAFETY CONSIDERATIONS.

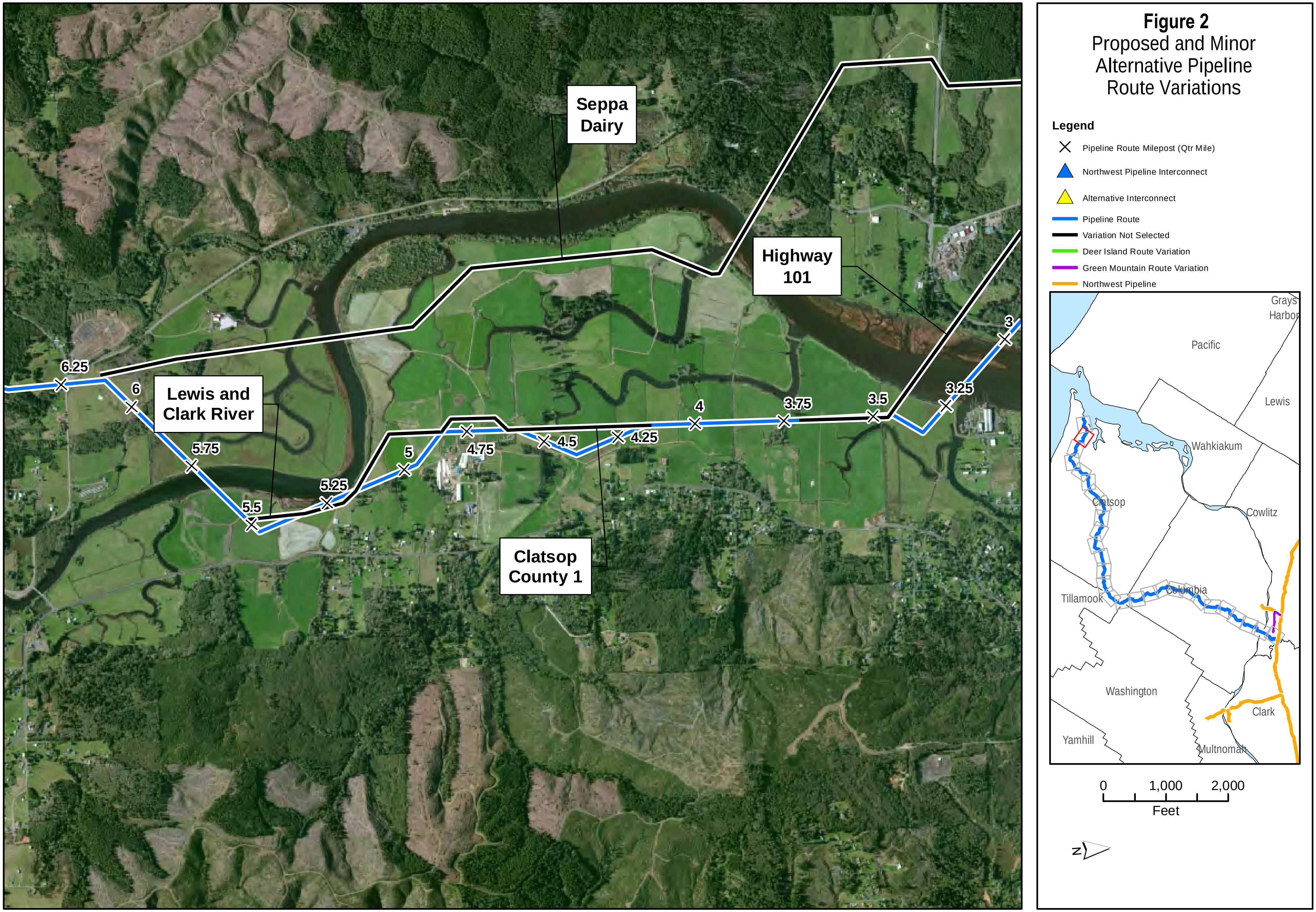
2. CONSTRUCTION EASEMENT WILL TYPICALLY BE 100' WIDE, CONSISTING OF A 50' PERMANENT EASEMENT AND A 50' OF TEMPORARY WORK SPACE. EXTRA TEMPORARY WORK SPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.

LEGEND	
TWS (TEMPORARY WORK SPACE)	COUNTY LINE
ATWS (ADDITIONAL TEMPORARY WORK SPACE)	PERMANENT EASEMENT LINE
PROPOSED ALIGNMENT MILE POST	ALIGNMENT PI (POINT OF INTERSECTION)
MAIN LINE VALVE	SECTION LINE
HDD (HORIZONTAL DIRECTIONAL DRILL) ACCESS POINT	ROADWAY CENTERLINE
WETLAND BOUNDARY	CITY LIMIT LINE
	PROPERTY LINE
	UTILITY LINE
	OVERHEAD POWER LINE

APPENDIX E3

PIPELINE ROUTE MINOR VARIATIONS


Terminal Reroute
Adairs Slough
Highway 101
Seppa Dairy
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
2.75
3
3.25
Figure 1
Proposed and Minor Alternative Pipeline Route Variations
Legend
Pipeline Route Milepost (Qtr Mile)
Northwest Pipeline Interconnect
Alternative Interconnect
Pipeline Route
Variation Not Selected
Deer Island Route Variation
Green Mountain Route Variation
Northwest Pipeline
Grays Harbor
Pacific
Lewis
Wahkiakum
Clatsop
Cowlitz
Tillamook
Columbia
Washington
Clark
Yamhill
Multnomah
0
1,000
2,000
Feet

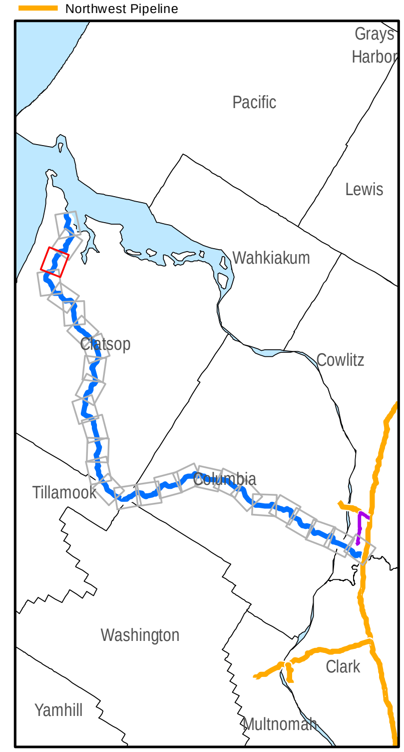


Seppa Dairy
Highway 101
Lewis and Clark River
Clatsop County 1
6.25
6
5.75
5.5
5.25
5
4.75
4.5
4.25
4
3.75
3.5
3.25
3
Figure 2
Proposed and Minor Alternative Pipeline Route Variations
Legend
Pipeline Route Milepost (Qtr Mile)
Northwest Pipeline Interconnect
Alternative Interconnect
Pipeline Route
Variation Not Selected
Deer Island Route Variation
Green Mountain Route Variation
Northwest Pipeline
Grays Harbor
Pacific
Lewis
Wahkiakum
Clatsop
Cowlitz
Columbia
Tillamook
Washington
Clark
Yamhill
Multnomah
0
1,000
2,000
Feet
N

Figure 3
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

N

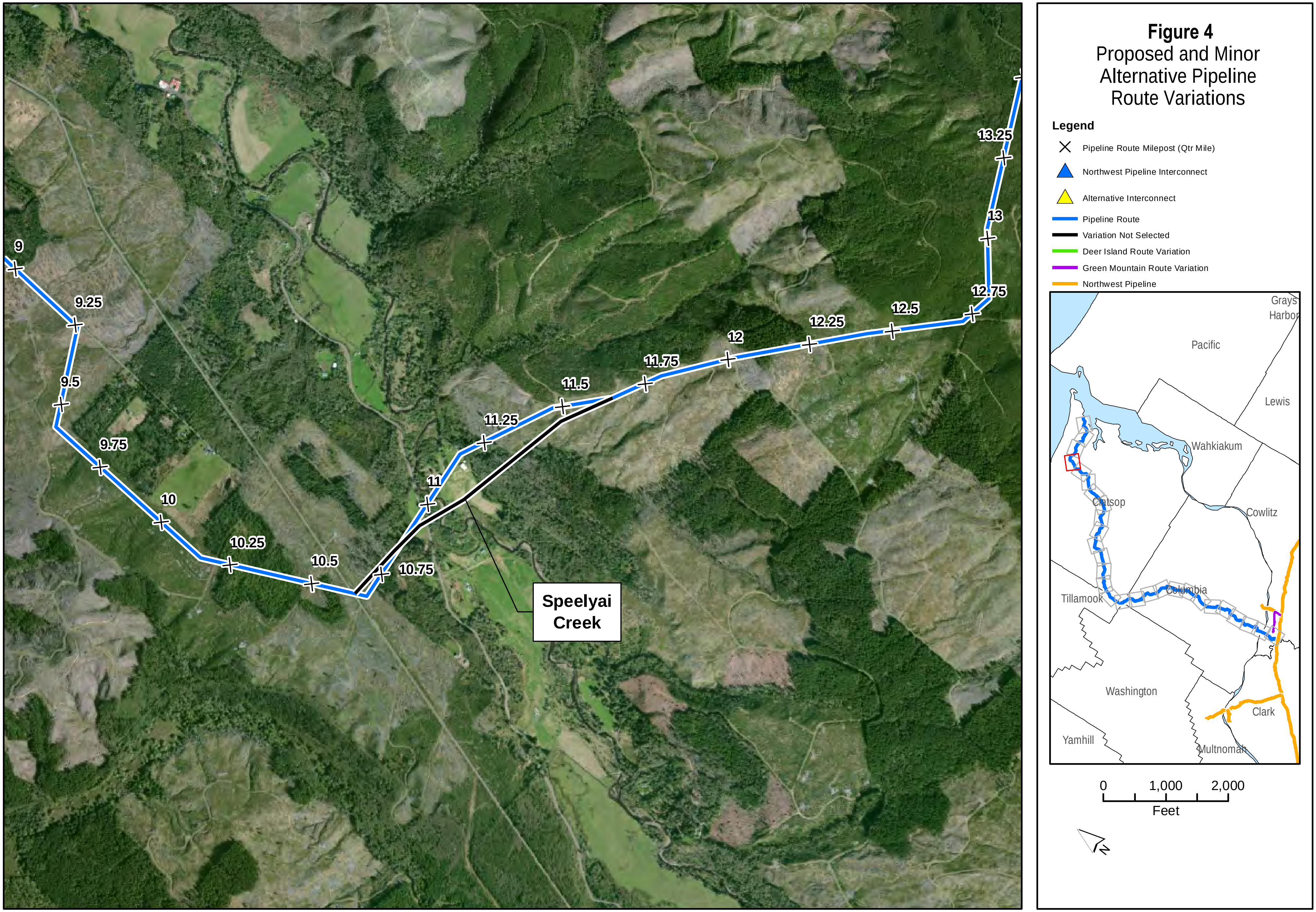
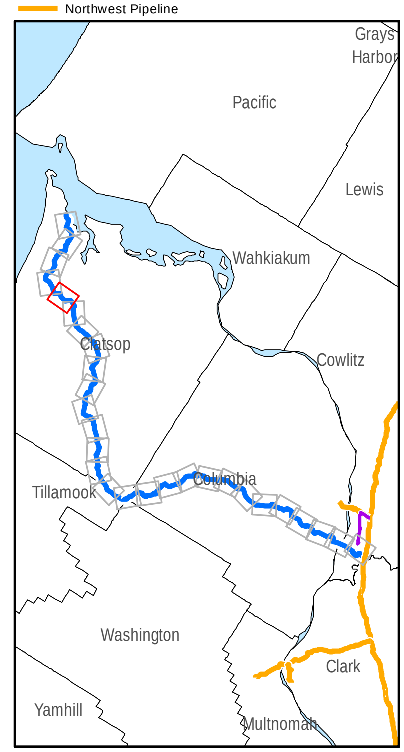


Figure 4
Proposed and Minor Alternative Pipeline Route Variations
Legend
Pipeline Route Milepost (Qtr Mile)
Northwest Pipeline Interconnect
Alternative Interconnect
Pipeline Route
Variation Not Selected
Deer Island Route Variation
Green Mountain Route Variation
Northwest Pipeline
Speelyai Creek
9
9.25
9.5
9.75
10
10.25
10.5
10.75
11
11.25
11.5
11.75
12
12.25
12.5
12.75
13
13.25
Grays Harbor
Pacific
Lewis
Wahkiakum
Clatsop
Cowlitz
Columbia
Tillamook
Washington
Clark
Yamhill
Multnomah
0
1,000
2,000
Feet

Figure 5
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



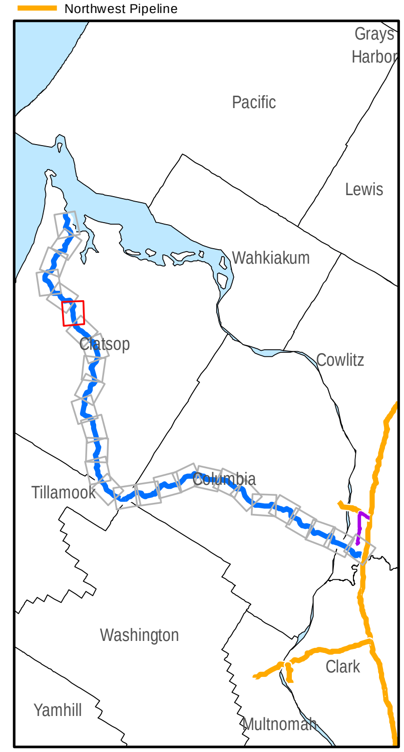
0 1,000 2,000
Feet

N

Figure 6
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline

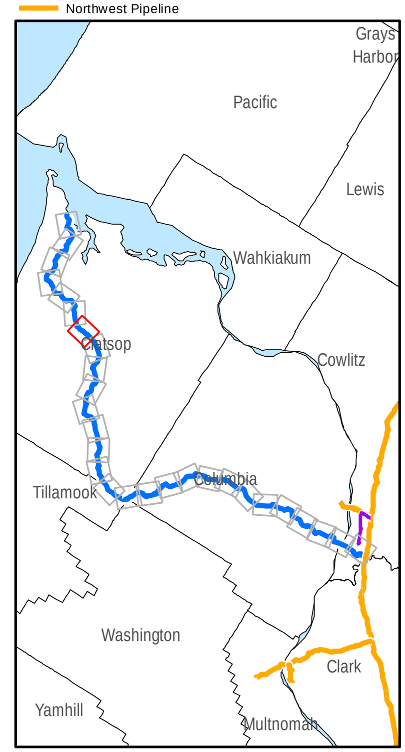


0 1,000 2,000
Feet

Figure 7
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

N

Figure 8
Proposed and Minor Alternative Pipeline Route Variations

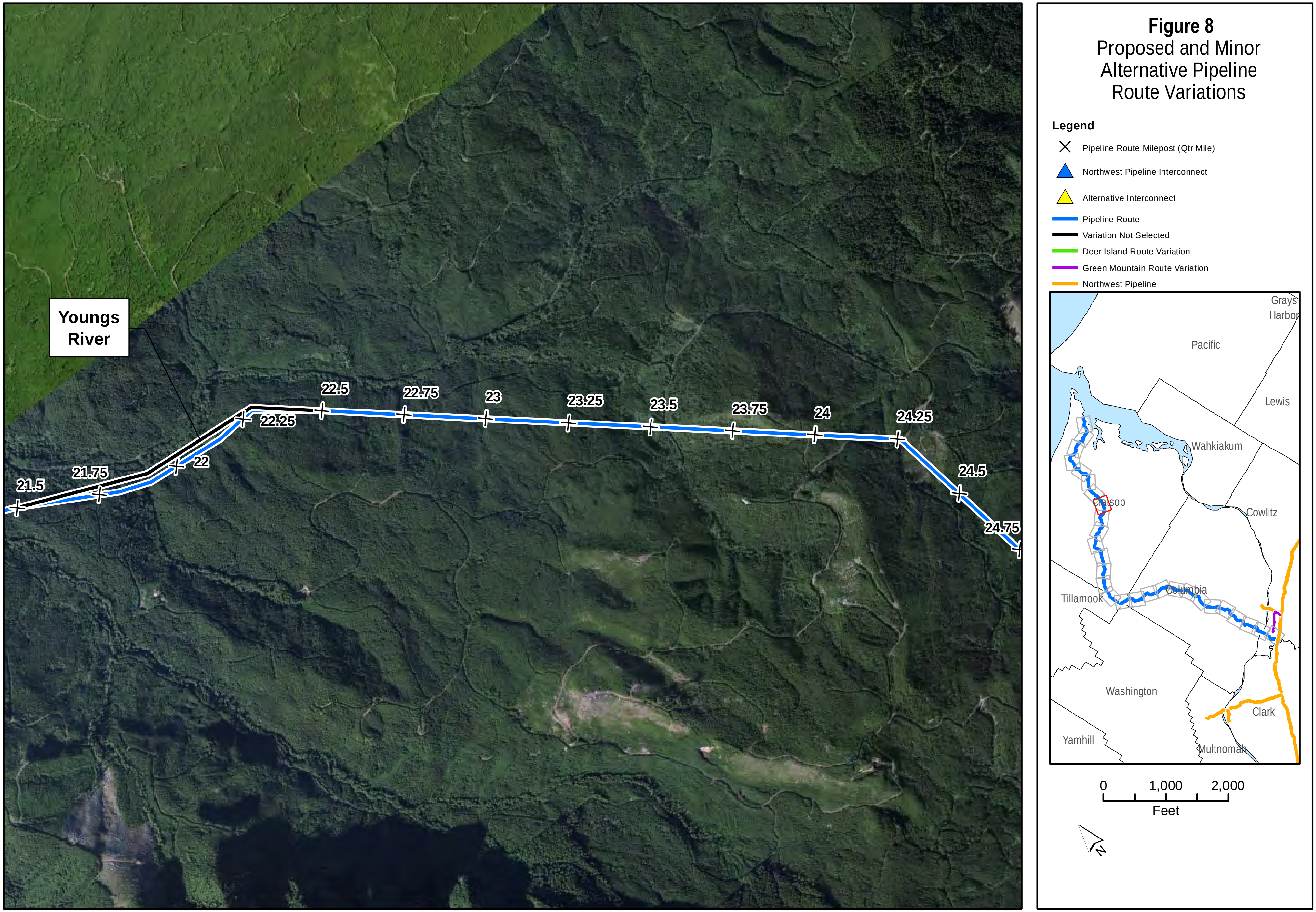
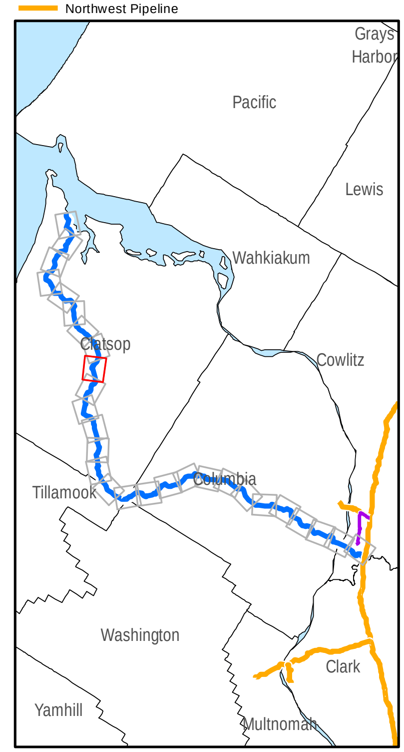


Figure 9
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline

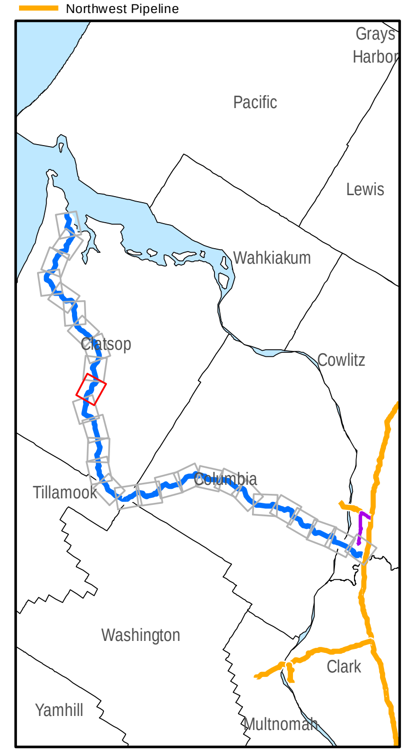


0 1,000 2,000
Feet

Figure 10
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline

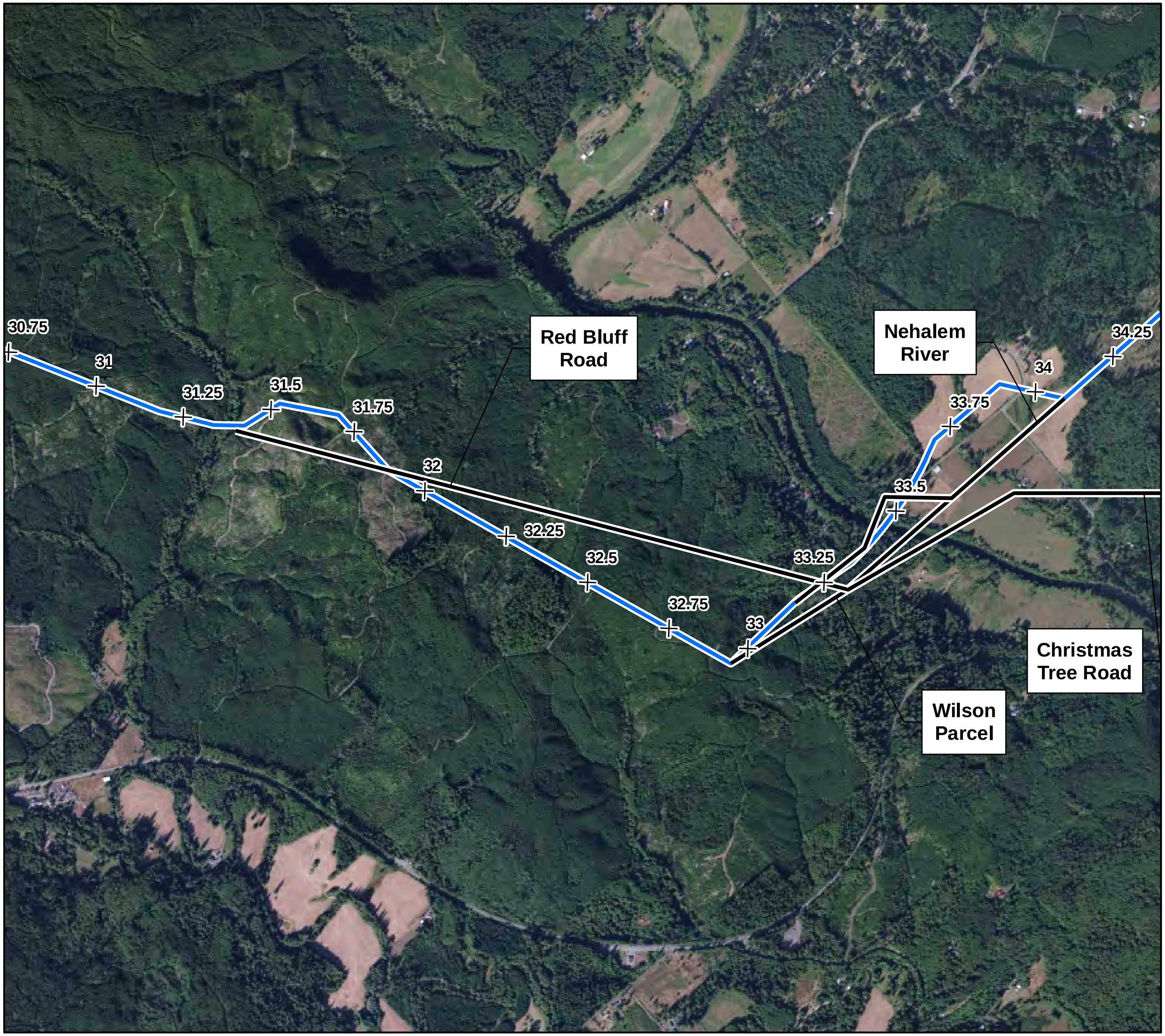


0 1,000 2,000
Feet

N

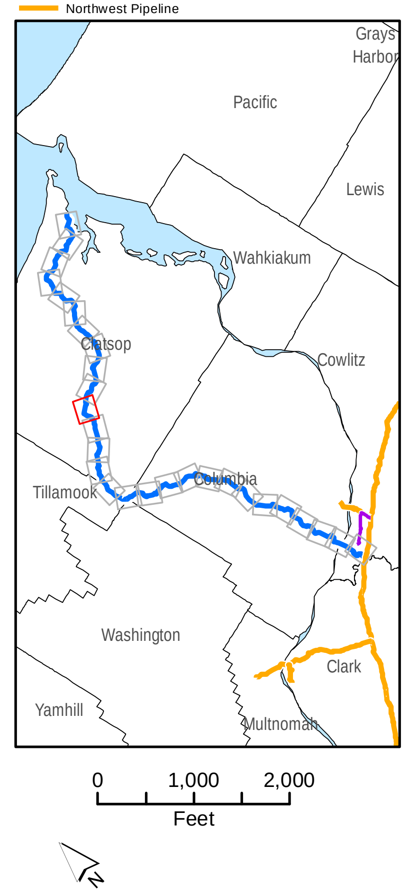
Figure 11

Proposed and Minor Alternative Pipeline Route Variations



Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



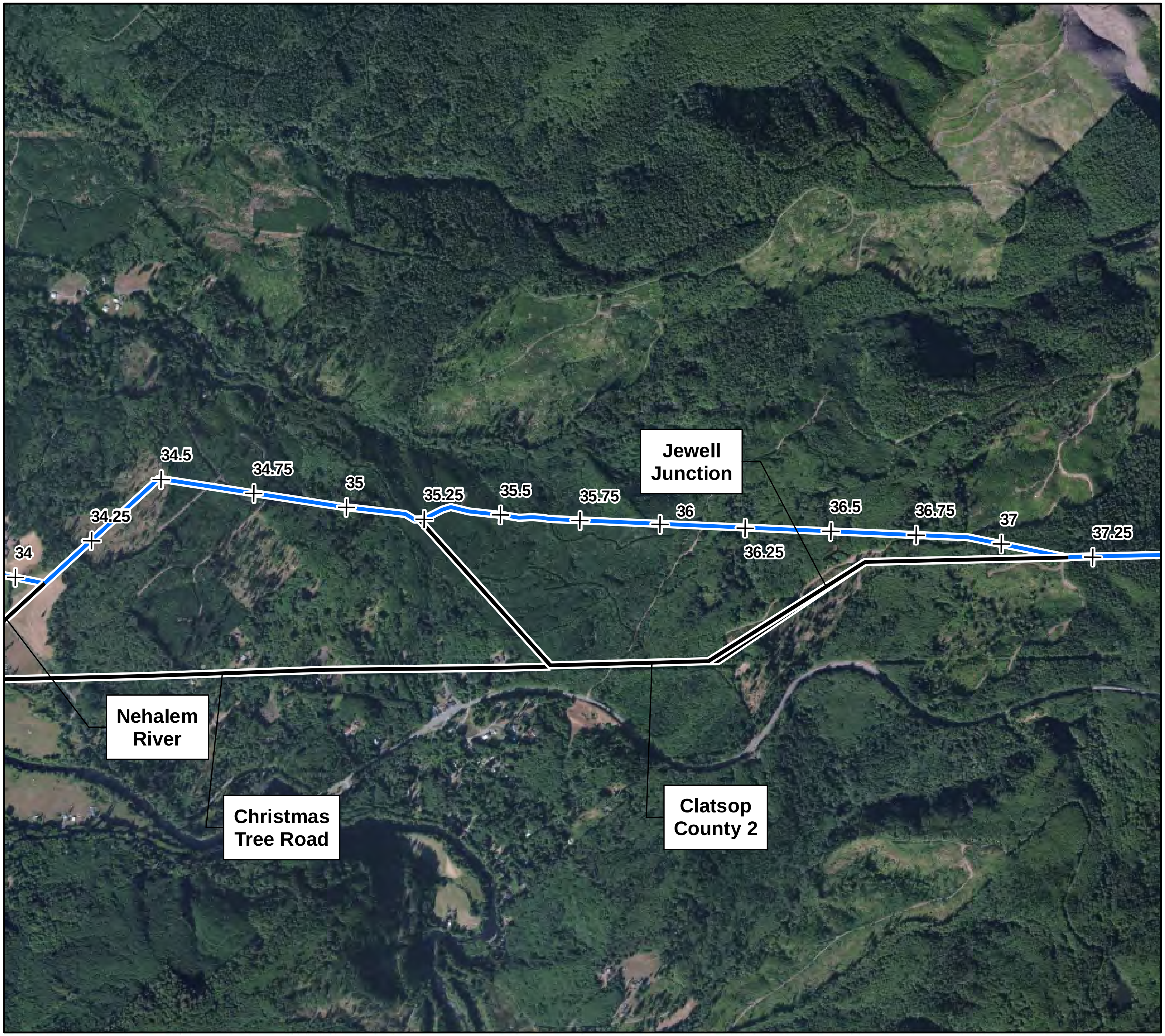


Figure 12
Proposed and Minor Alternative Pipeline Route Variations

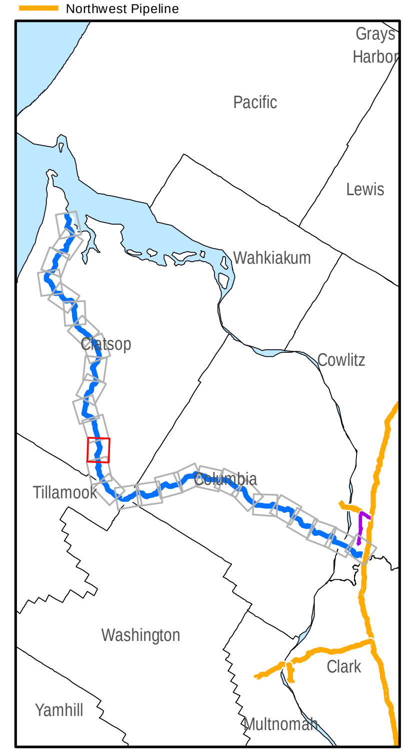
Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline

Figure 13
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

N

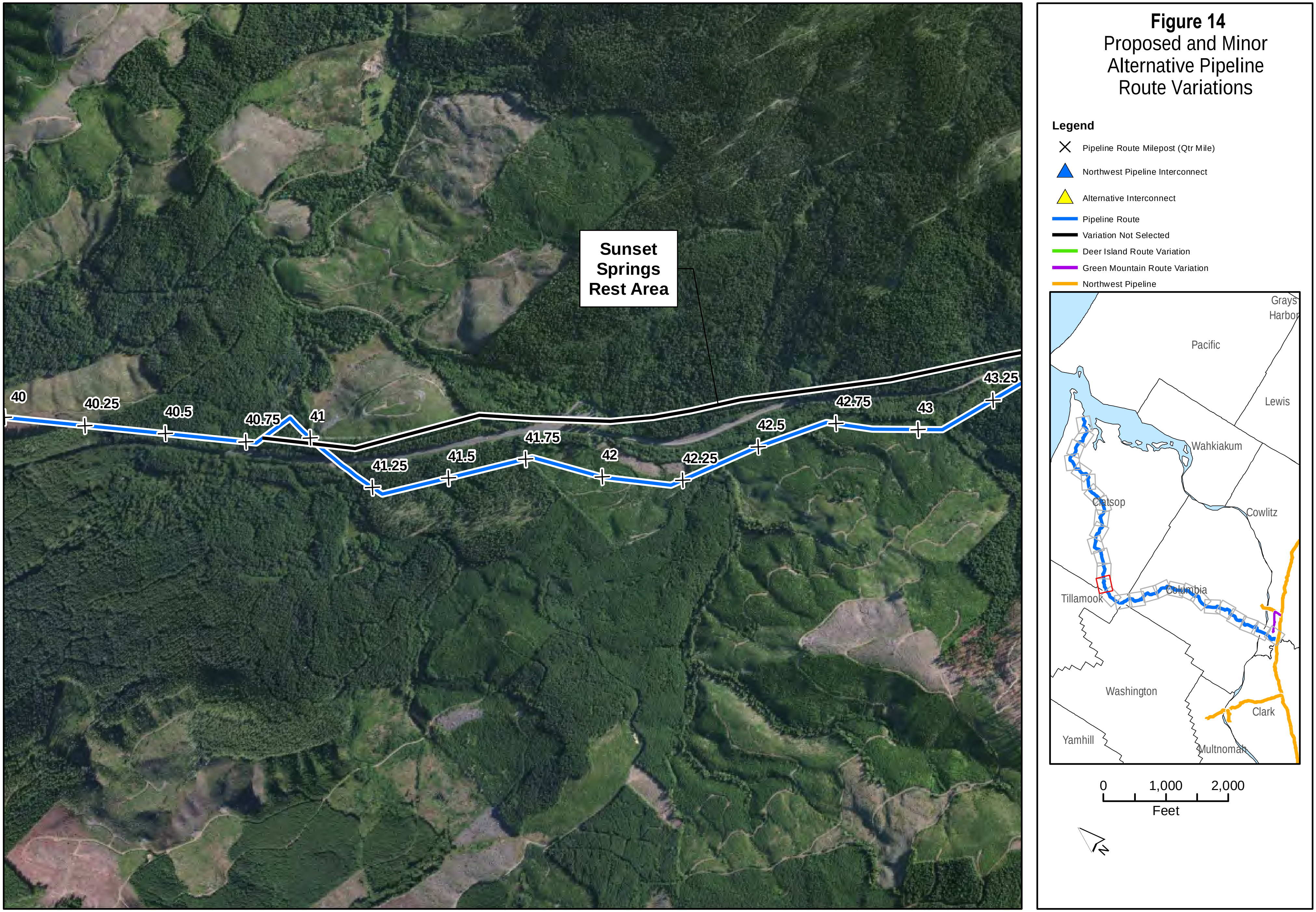


Figure 14
Proposed and Minor Alternative Pipeline Route Variations

PUBLIC

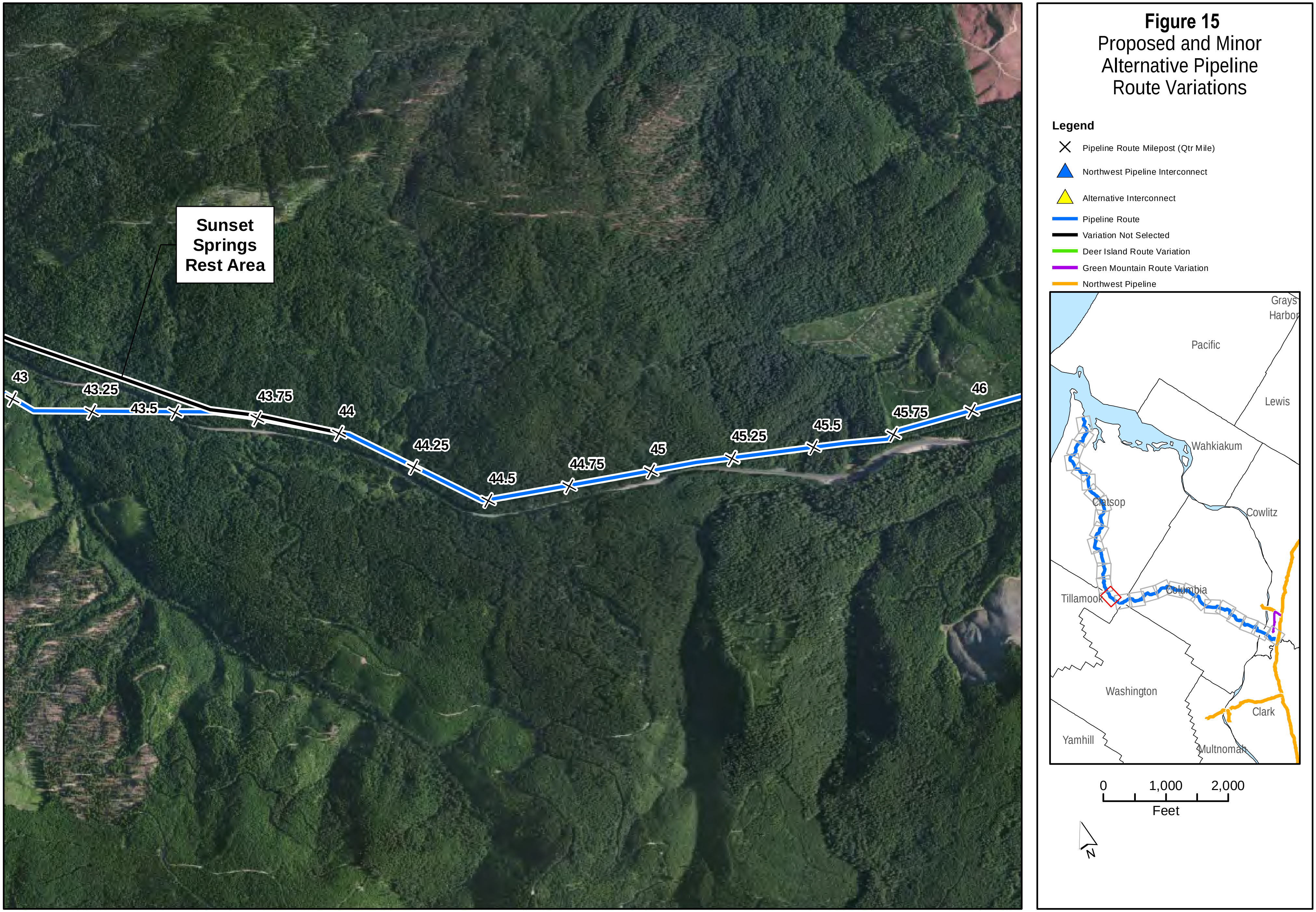


Figure 15
Proposed and Minor Alternative Pipeline Route Variations

Legend
Pipeline Route Milepost (Qtr Mile)
Northwest Pipeline Interconnect
Alternative Interconnect
Pipeline Route
Variation Not Selected
Deer Island Route Variation
Green Mountain Route Variation
Northwest Pipeline

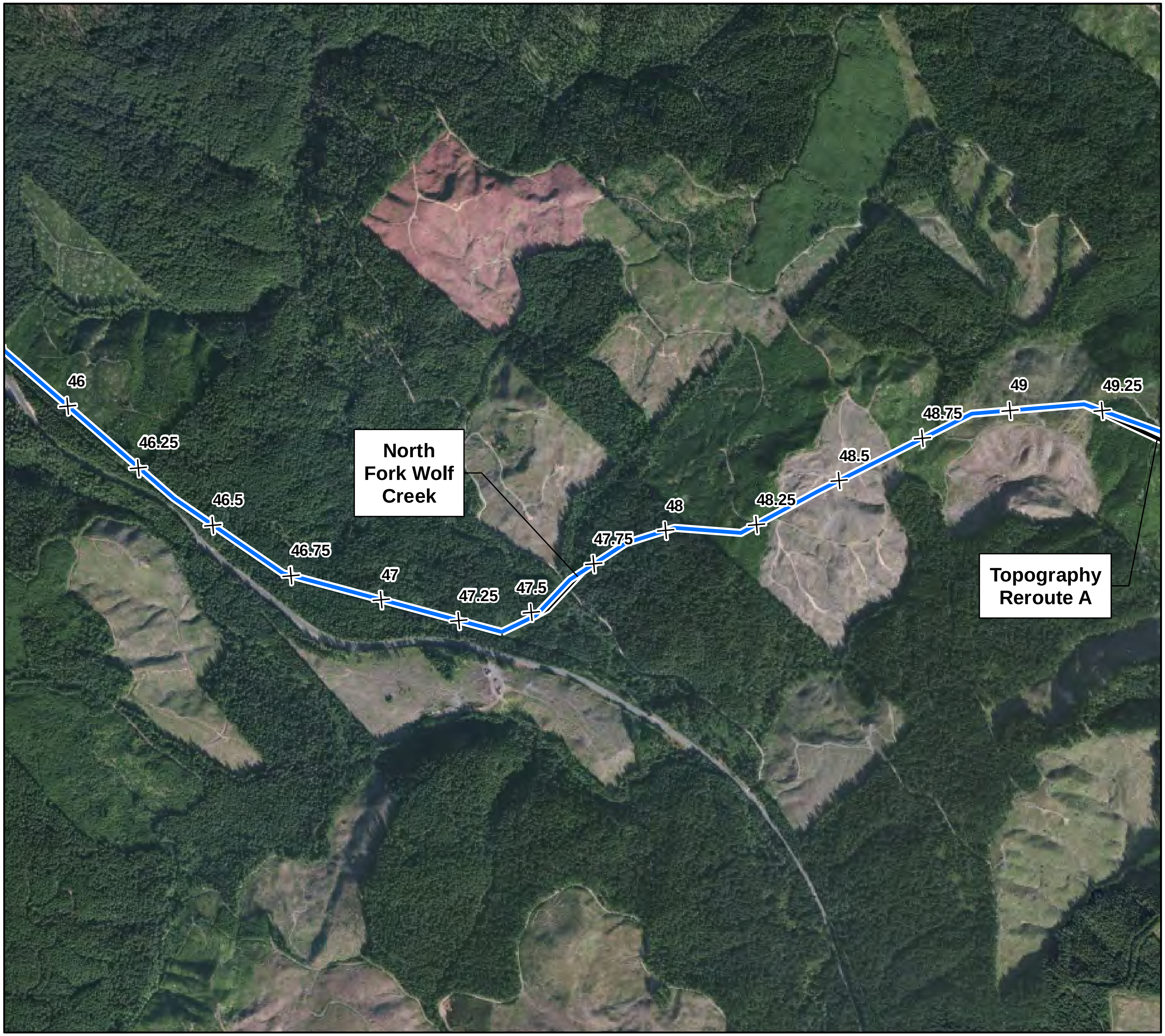
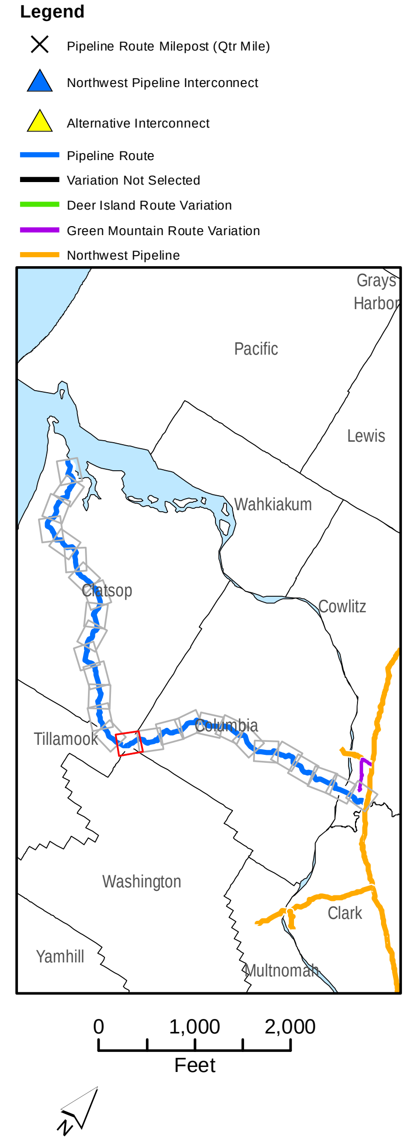


Figure 16
Proposed and Minor Alternative Pipeline Route Variations



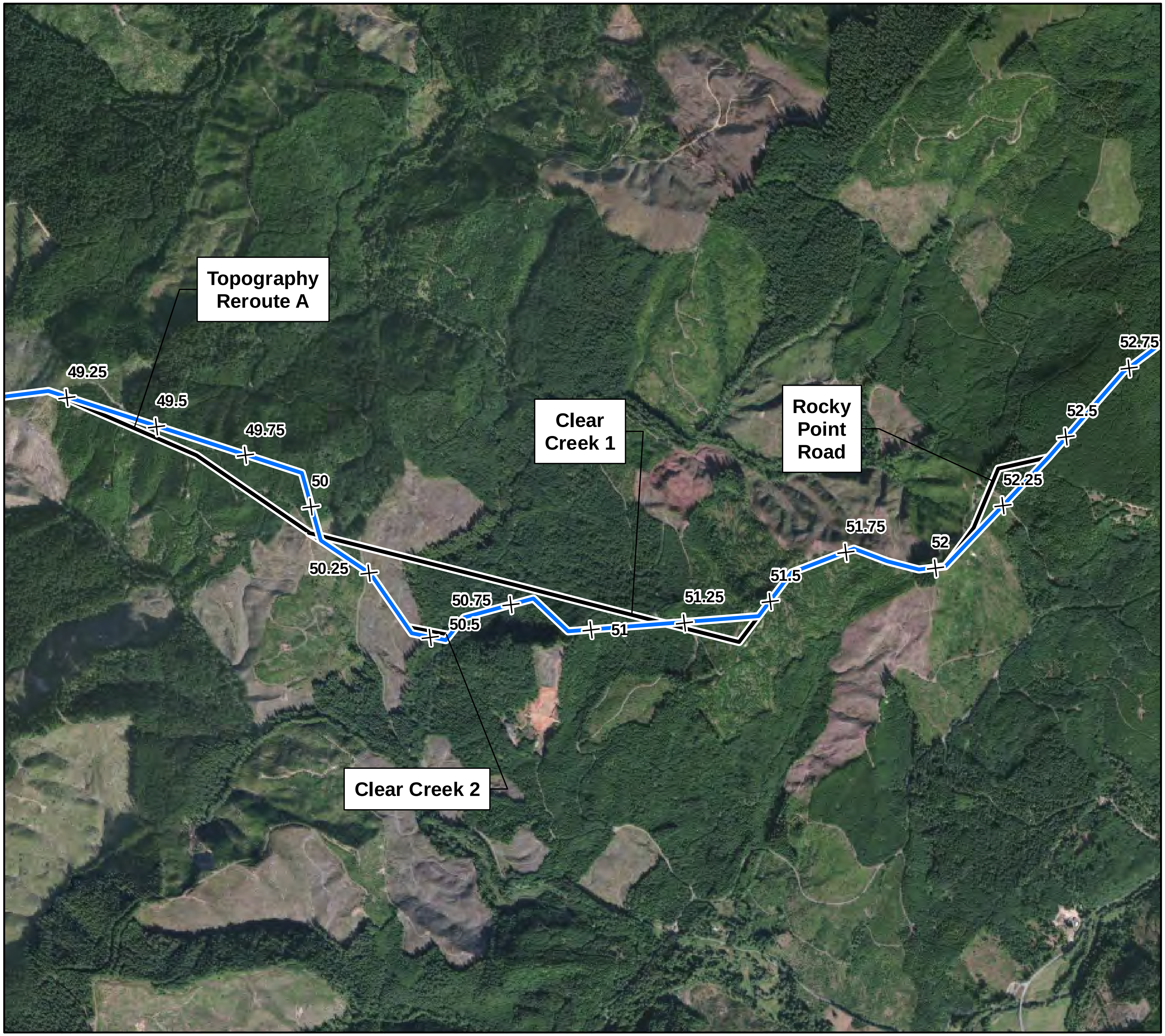
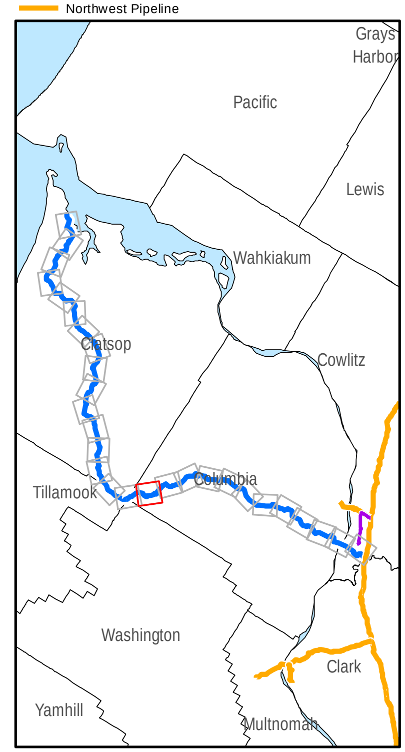


Figure 17
Proposed and Minor Alternative Pipeline Route Variations

Legend

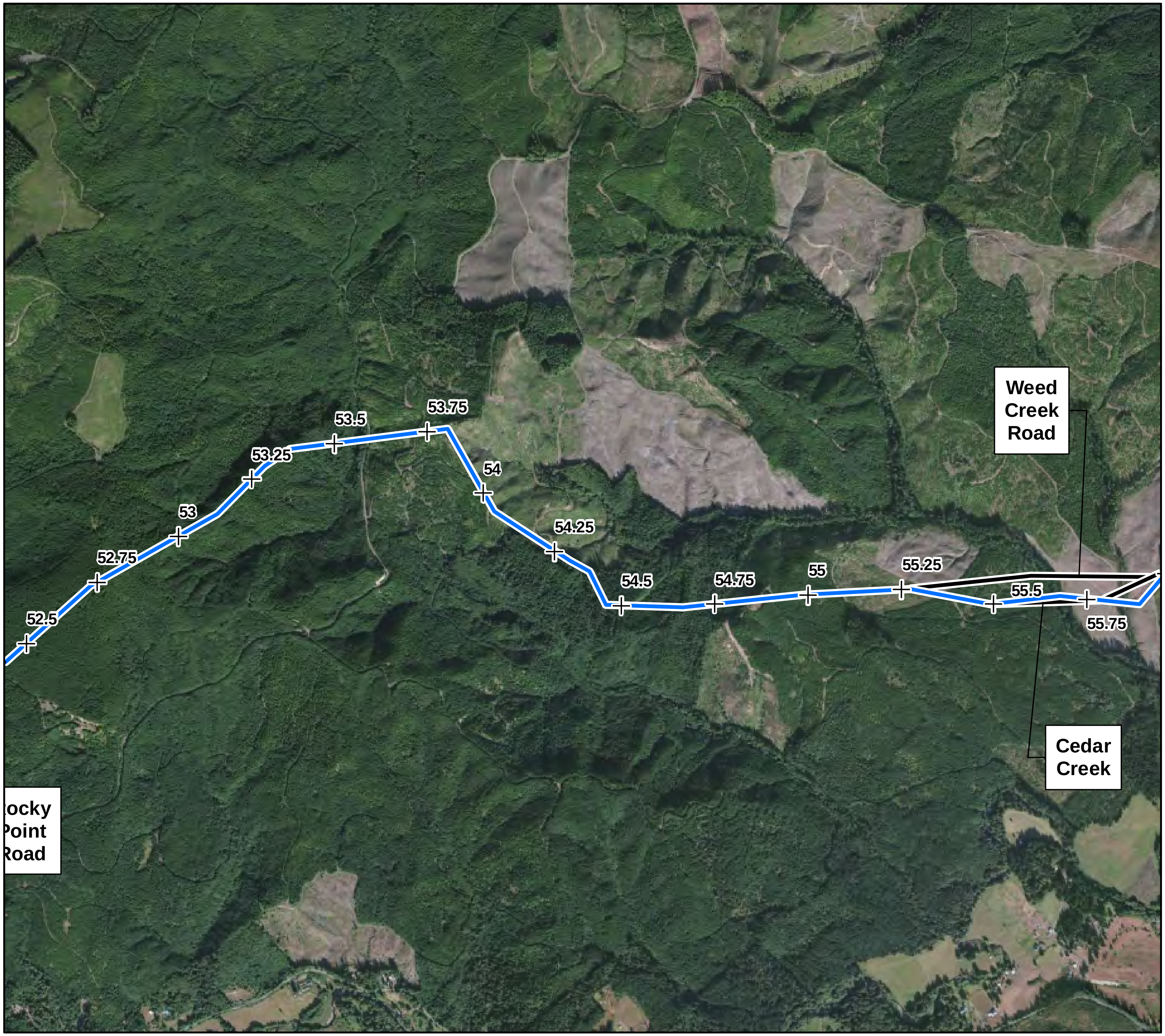
- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



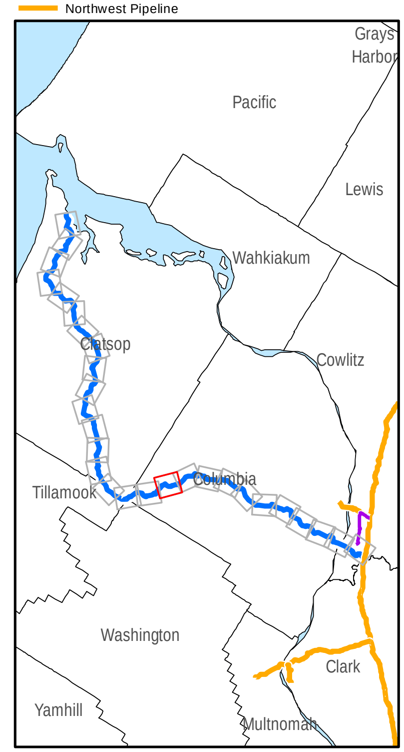
0 1,000 2,000
Feet

N

Figure 18
Proposed and Minor Alternative Pipeline Route Variations



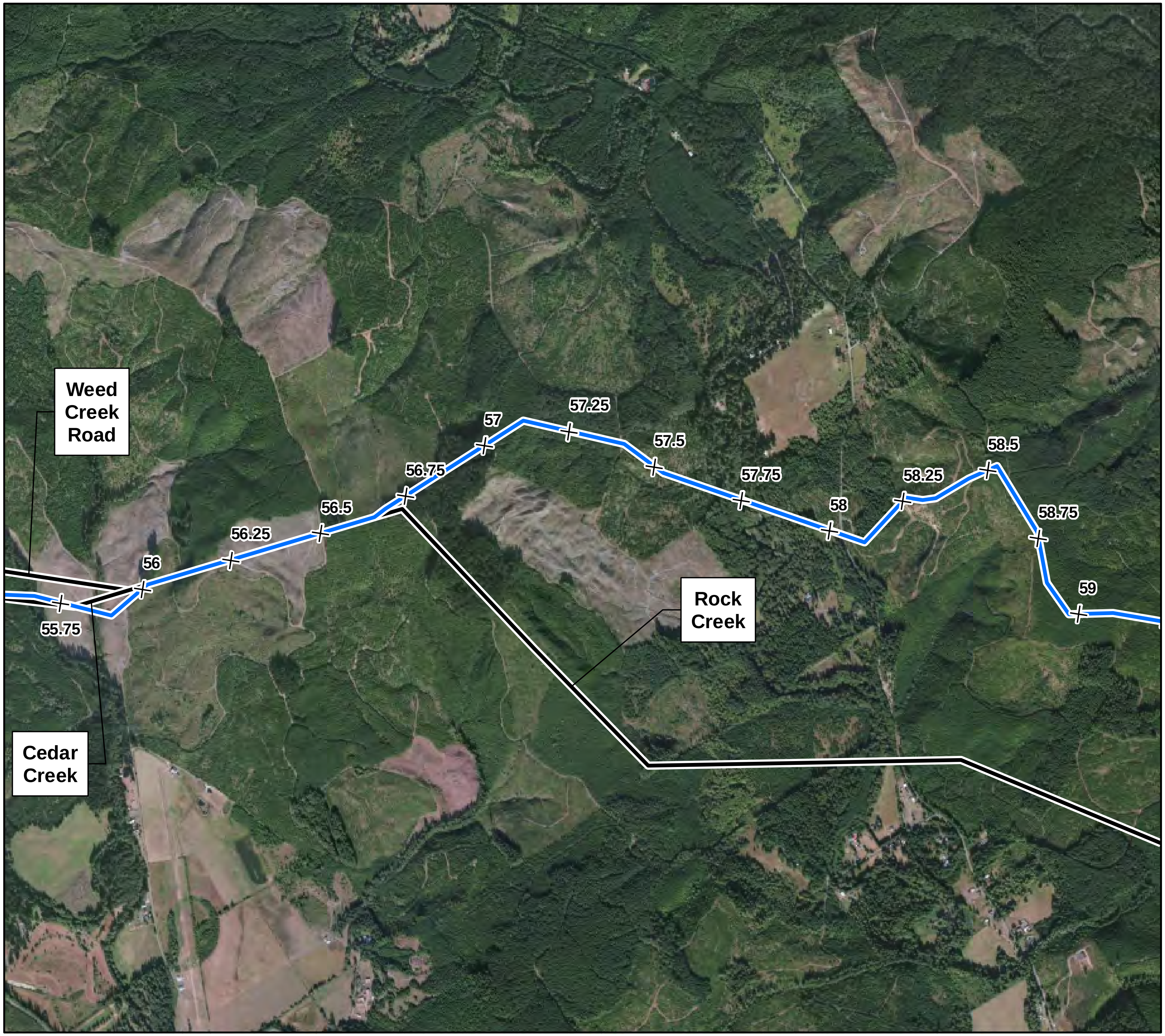
Legend
- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

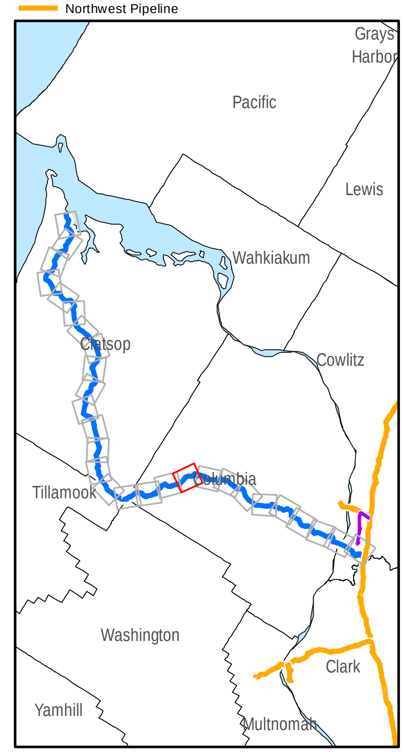
N

Figure 19
Proposed and Minor Alternative Pipeline Route Variations



Legend

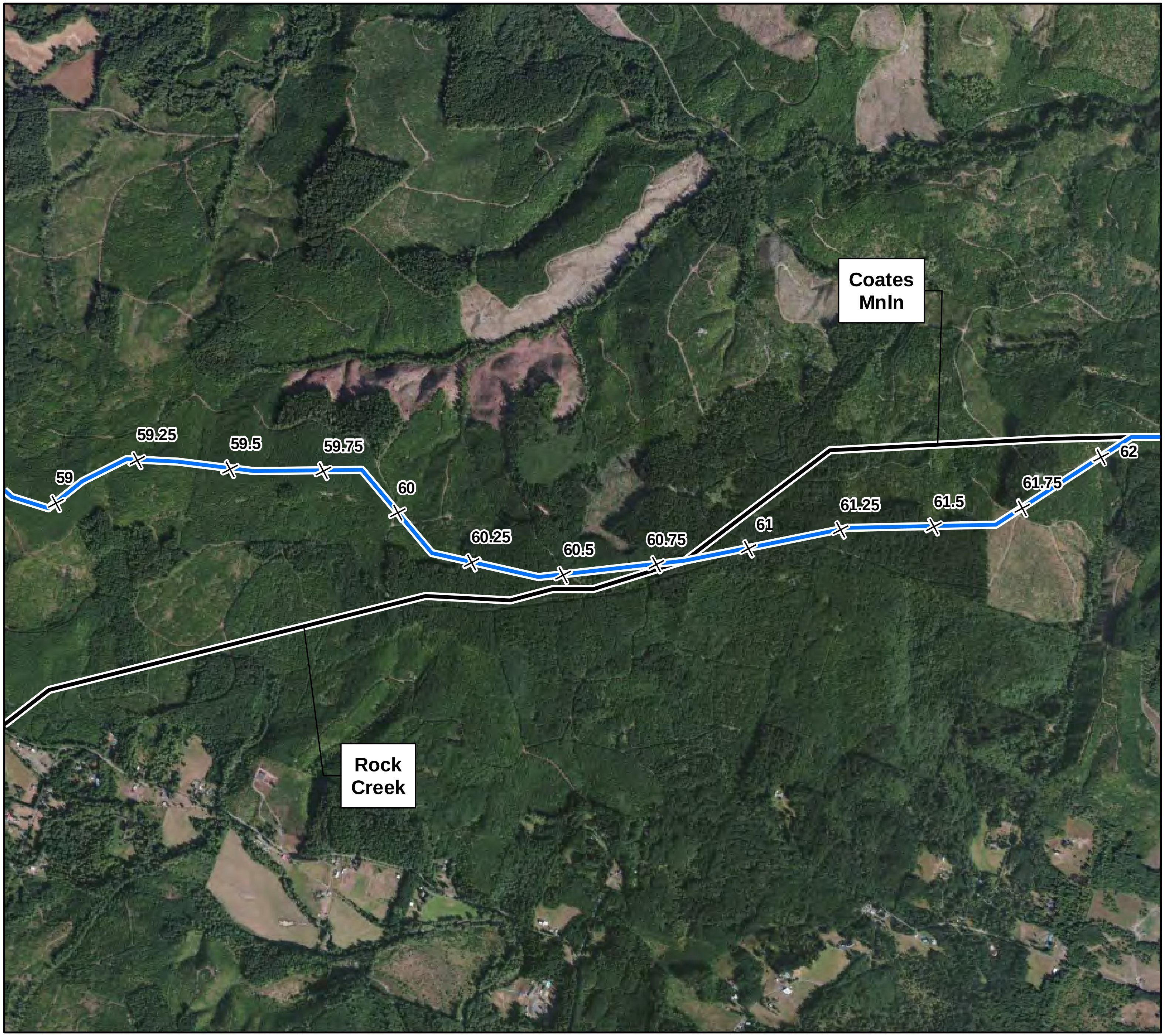
- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

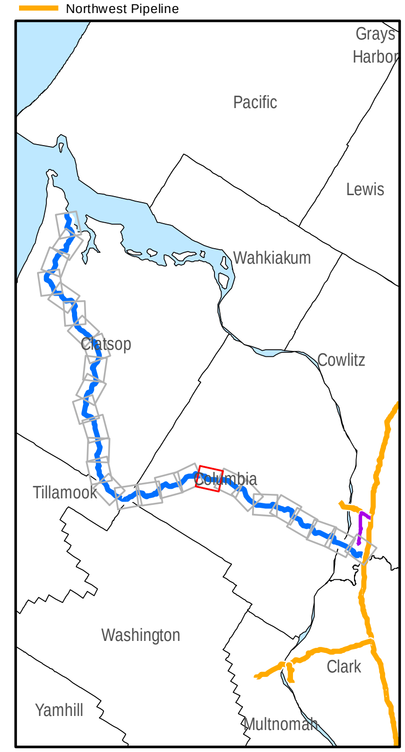
N

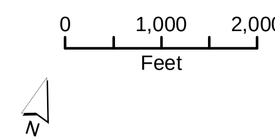
Figure 20
Proposed and Minor Alternative Pipeline Route Variations



Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline





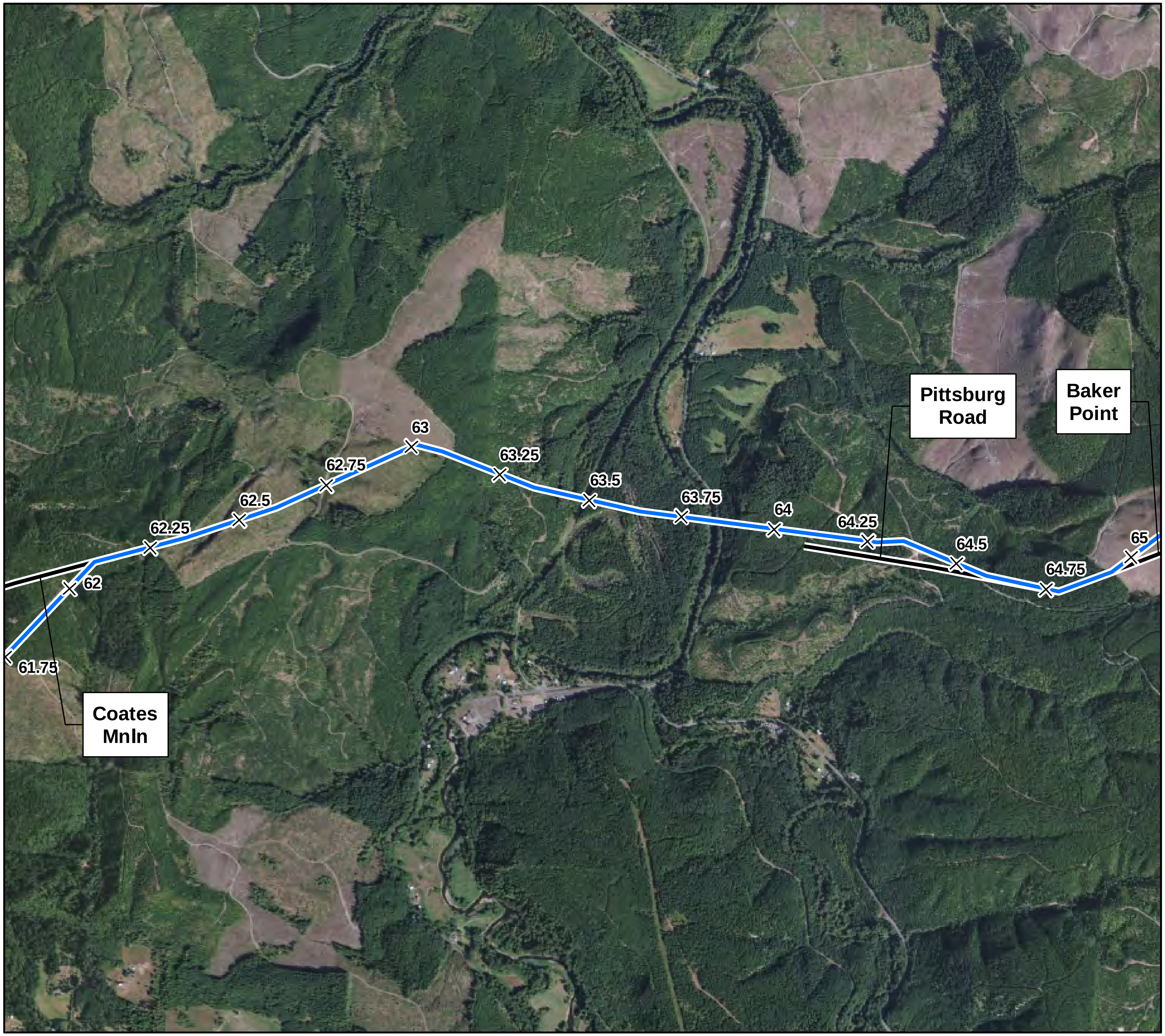
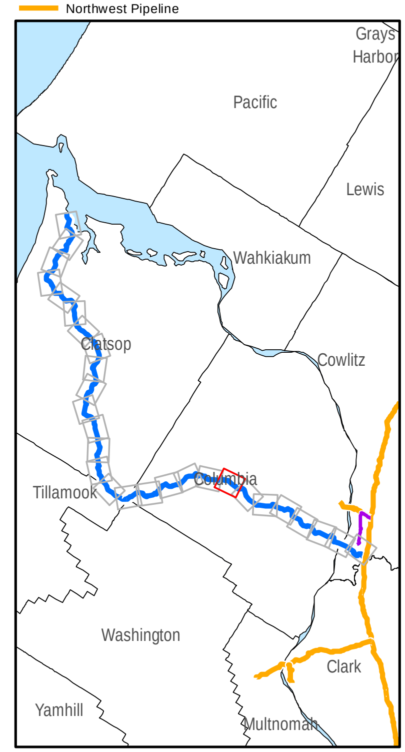


Figure 21
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

N

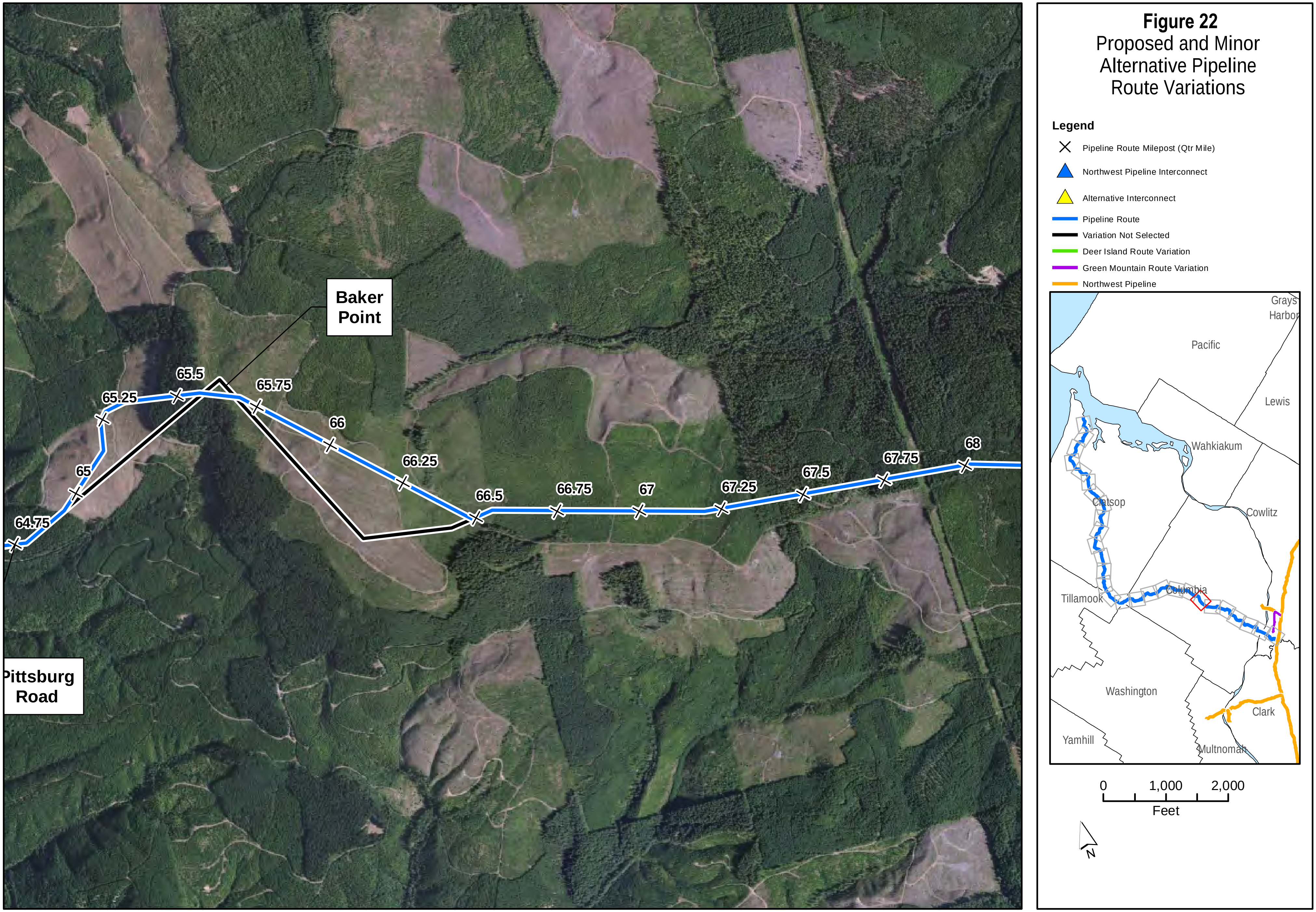


Figure 22
Proposed and Minor Alternative Pipeline Route Variations
Legend
Pipeline Route Milepost (Qtr Mile)
Northwest Pipeline Interconnect
Alternative Interconnect
Pipeline Route
Variation Not Selected
Deer Island Route Variation
Green Mountain Route Variation
Northwest Pipeline
Baker Point
Pittsburg Road
64.75
65
65.25
65.5
65.75
66
66.25
66.5
66.75
67
67.25
67.5
67.75
68
Grays Harbor
Pacific
Lewis
Wahkiakum
Clatsop
Cowlitz
Columbia
Tillamook
Washington
Clark
Yamhill
Multnomah
0
1,000
2,000
Feet
N

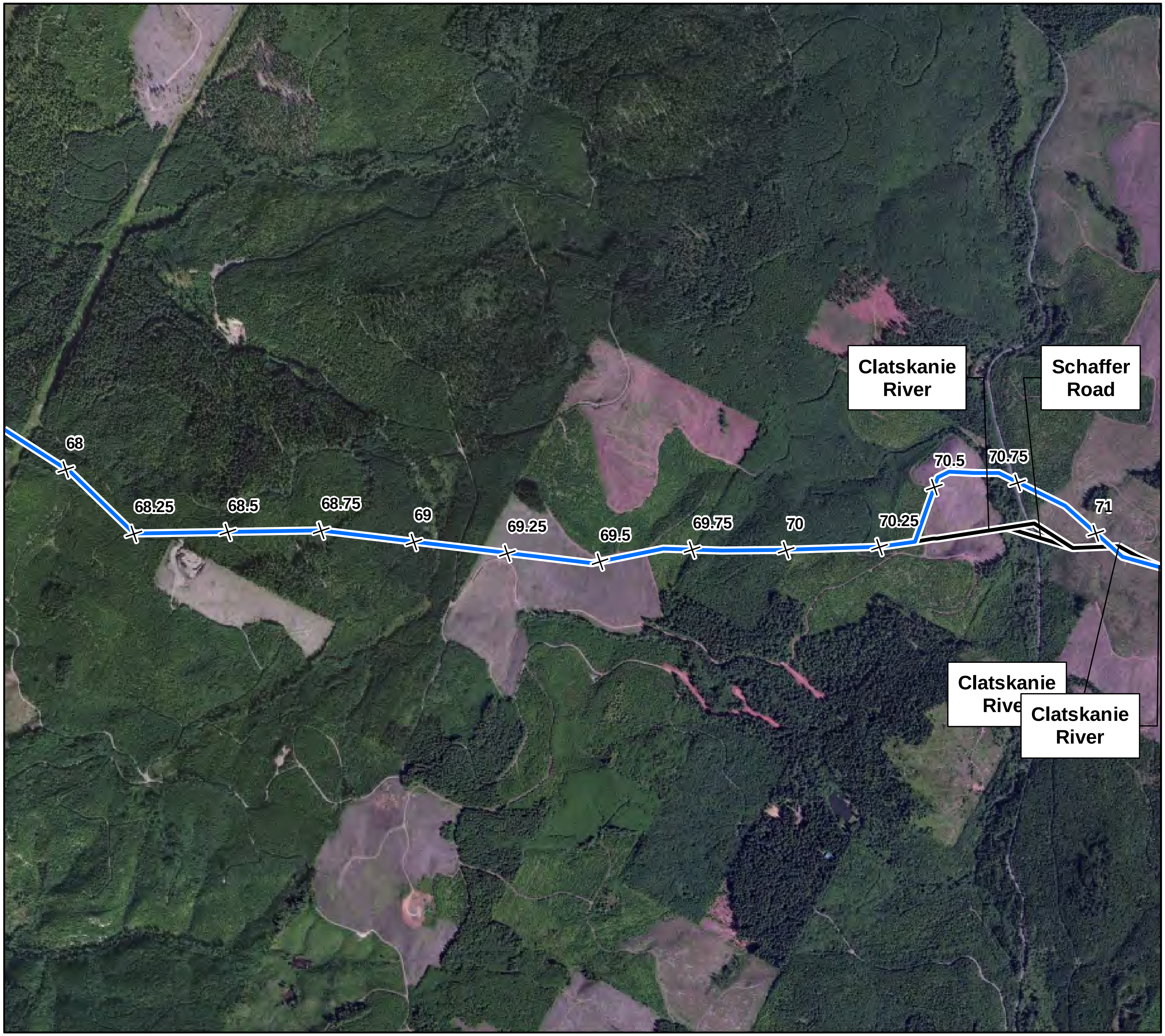
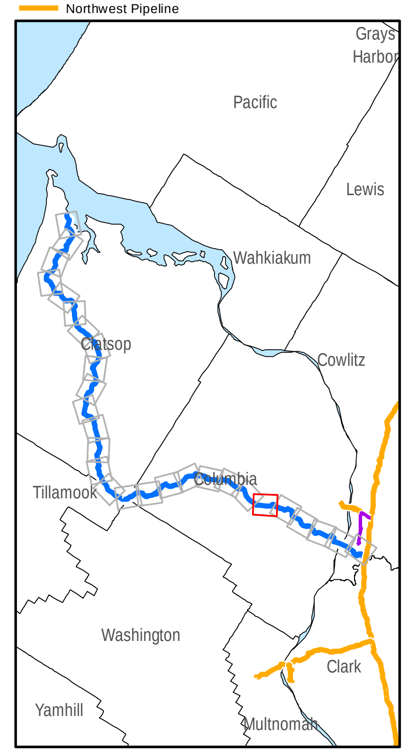


Figure 23
Proposed and Minor Alternative Pipeline Route Variations

Legend

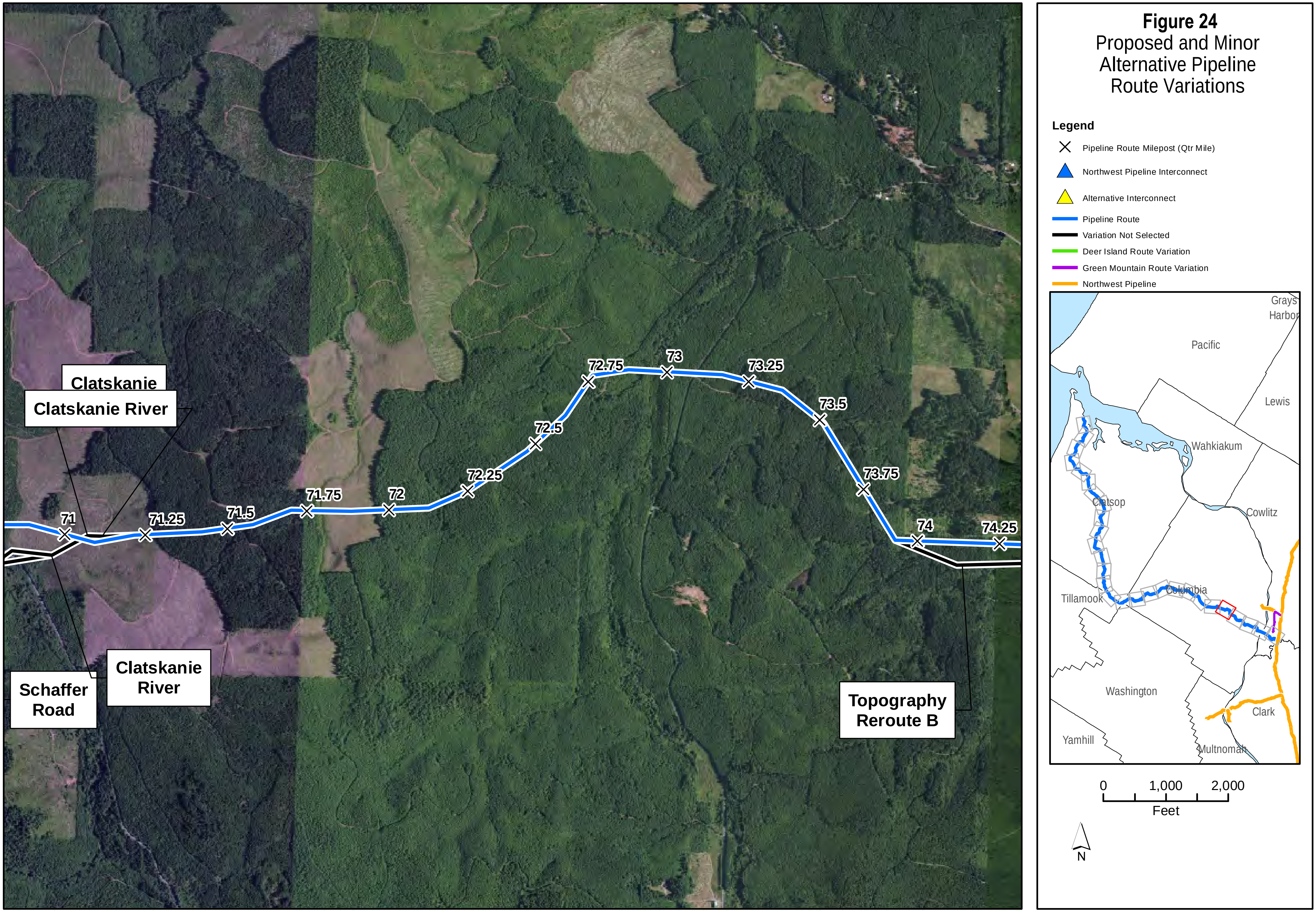
- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

N

Figure 24
Proposed and Minor Alternative Pipeline Route Variations



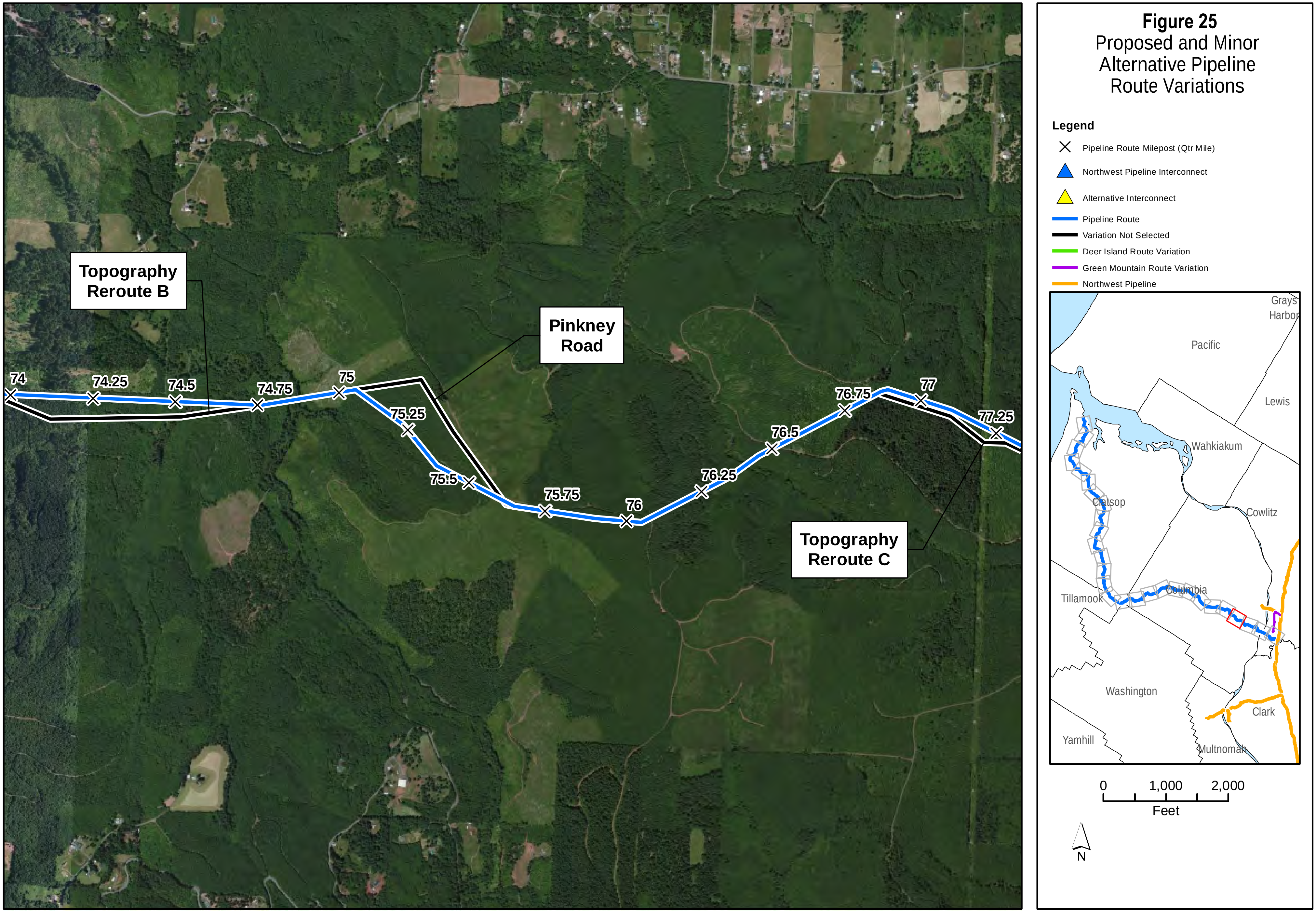


Figure 25
Proposed and Minor Alternative Pipeline Route Variations
Legend
Pipeline Route Milepost (Qtr Mile)
Northwest Pipeline Interconnect
Alternative Interconnect
Pipeline Route
Variation Not Selected
Deer Island Route Variation
Green Mountain Route Variation
Northwest Pipeline
Topography Reroute B
Pinkney Road
Topography Reroute C
74
74.25
74.5
74.75
75
75.25
75.5
75.75
76
76.25
76.5
76.75
77
77.25
Grays Harbor
Pacific
Lewis
Wahkiakum
Clatsop
Cowlitz
Tillamook
Columbia
Washington
Clark
Yamhill
Multnomah
0
1,000
2,000
Feet
N

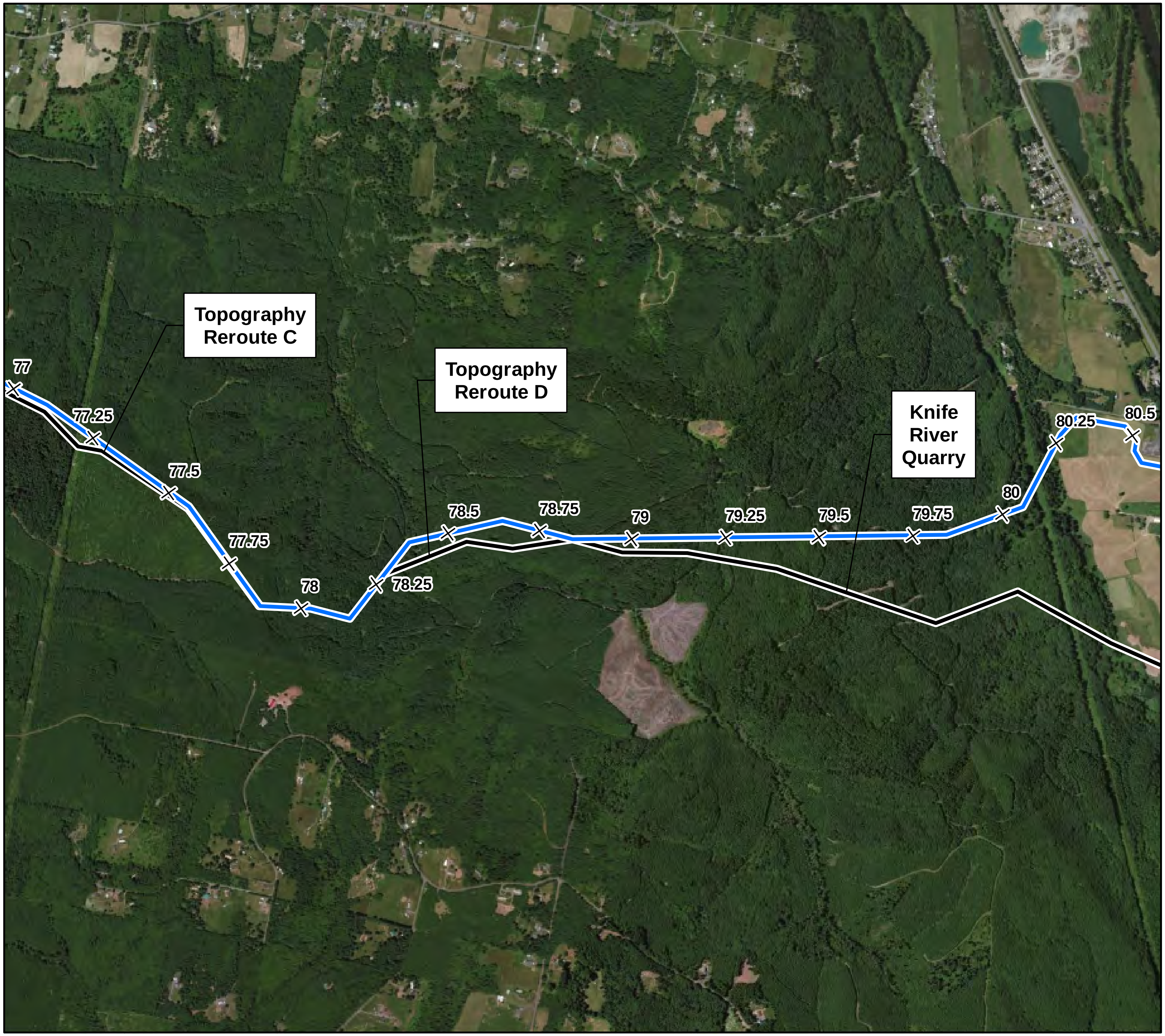
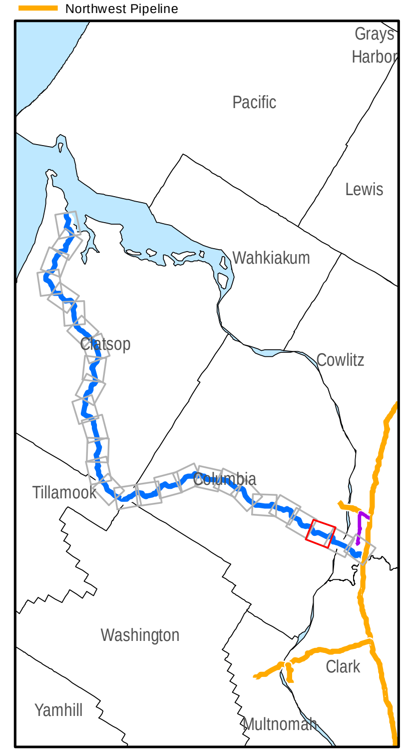


Figure 26
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

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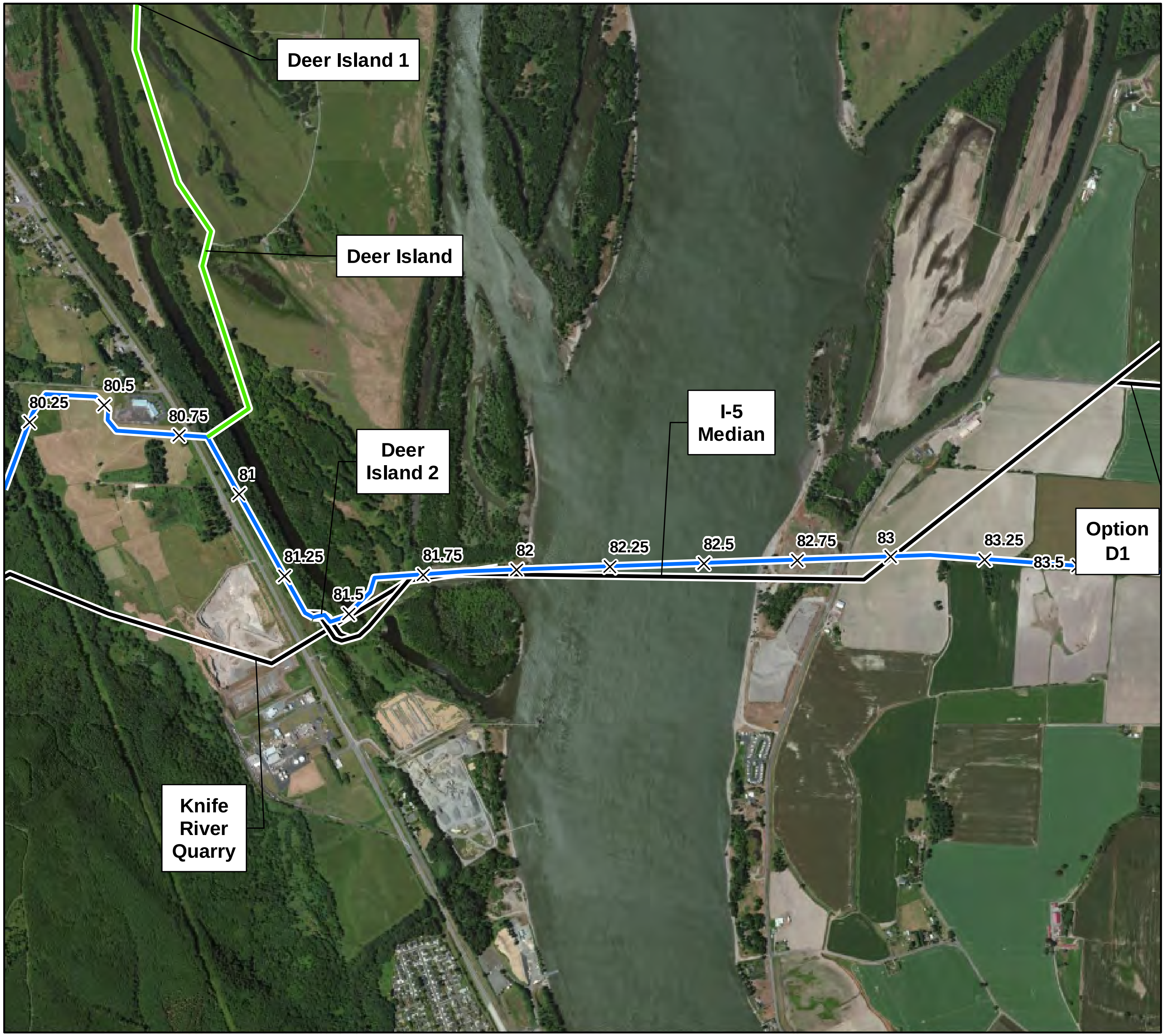
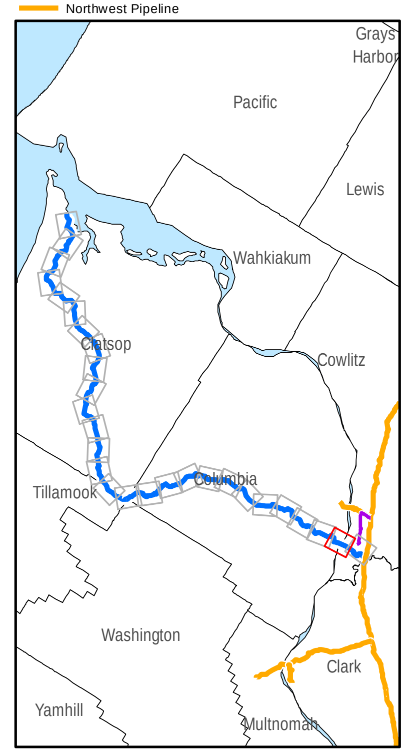


Figure 27
Proposed and Minor Alternative Pipeline Route Variations

Legend

- Pipeline Route Milepost (Qtr Mile)
- Northwest Pipeline Interconnect
- Alternative Interconnect
- Pipeline Route
- Variation Not Selected
- Deer Island Route Variation
- Green Mountain Route Variation
- Northwest Pipeline



0 1,000 2,000
Feet

N

APPENDIX E4

ADDITIONAL TEMPORARY WORKSPACE FOR THE PIPELINE; ADDITIONAL TEMPORARY WORKSPACES WITHIN 50 FEET OF WETLANDS AND WATERBODIES

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	0.1	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 100	0.02	OS
					0.10	PEM
Clatsop	0.2	Point of Intersection	Additional Spoils Area	407 x 123	1.12	EW
					0.03	OS
Clatsop	0.6	Slough/Waterbody	Additional Spoil Area/Staging Area	175 x 50	0.20	EW
Clatsop	0.6	Slough/Waterbody	Additional Spoil Area/Staging Area	175 x 100	0.41	EW
Clatsop	0.8	Highway 101 Crossing	Additional Spoil Area/Staging Area	512 x 50	0.56	EW
Clatsop	0.8	Highway 101 Crossing	Additional Spoil Area/Staging Area	373 x 117	0.74	EW
Clatsop	0.8	Highway 101 Crossing	Additional Spoil Area/Staging Area	85 x 50	0.07	EW
					0.03	OS
Clatsop	1.1	Slough/Waterbody	Additional Spoil Area/Staging Area	535 x 180	1.73	EW
Clatsop	1.5	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 200	0.23	AW
Clatsop	1.7	Airport Road	Bore Pit and Equipment	50 x 175	0.10	AW
Clatsop	1.7	Airport Road	Bore Pit and Equipment	50 x 175	0.08	AW
Clatsop	1.7	Airport Road	Bore Pit and Equipment	50 x 175	0.20	AW
Clatsop	1.7	Airport Road	Bore Pit and Equipment	50 x 175	0.21	AW
Clatsop	1.8	Point of Intersection	Additional Spoils Area	50 x 100	0.17	UF
Clatsop	2.3	Clatsop Airport Road	Bore Pit and Equipment	50 x 150	0.17	ROW
					0.03	PSS
Clatsop	2.4	Clatsop Airport Road	Bore Pit and Equipment	50 x 425	0.51	PEM
					0.01	PSS
					0.03	OS
Clatsop	2.4	Clatsop Airport Road	Bore Pit and Equipment	50 x 200	.02	AG
					.02	PEM
					0.19	PSS
					0.02	ROW
Clatsop	2.4	Clatsop Airport Road	Bore Pit and Equipment	50 x 175	0.12	PSS
					0.09	PEM
Clatsop	2.8	Lewis and Clark River	HDD Equipment Pad	125 x 300	0.21	UF
					0.76	PSS
Clatsop	3.4	Lewis and Clark River	HDD Equipment Pad/Pullback	150 x 300	0.95	AW
Clatsop	3.7	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 500	0.57	AW
Clatsop	4.0	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 770	0.88	AW
Clatsop	4.1	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 400	0.46	AW

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	4.2	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 350	0.32	AW
					0.08	PEM
Clatsop	4.4	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 1100	1.27	PEM
Clatsop	4.6	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 125	0.14	PEM
Clatsop	4.6	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 175	0.20	AW
Clatsop	4.7	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 150	0.17	AW
Clatsop	4.8	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 250	0.29	AW
Clatsop	4.9	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 325	0.37	AW
Clatsop	5.0	Lewis and Clark River Bank	HDD Equipment Pad	80 x 300	0.55	AW
Clatsop	5.4	Lewis and Clark River	HDD Pullback	75 x 410	0.70	AW
Clatsop	5.5	Lewis and Clark River Bank	HDD Equipment Pad/Pullback/ Additional Spoil Area/Staging Area	50 x 325 & 75 x 1300	2.50	AW
Clatsop	5.5	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 225	0.27	AW
Clatsop	5.5	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 320	0.37	AW
Clatsop	5.6	Slough/Waterbody	Additional Spoil Area/Staging Area	50 x 200	0.23	AW
Clatsop	5.6	Lewis and Clark River	HDD Equipment Pad	80 x 250	0.46	AW
Clatsop	6	Lewis and Clark River	HDD Equipment Pad	80 x 300	0.55	OS
Clatsop	6.1	Point of Intersection	Additional Spoil Area	50 x 300	0.36	OS
Clatsop	6.2	Point of Intersection	Additional Spoil Area	50 x 175	0.20	OS
Clatsop	6.3	Point of Intersection	Additional Spoil Area	50 x 175	0.05	IF
					0.10	AG
					0.05	PEM
Clatsop	6.3	Point of Intersection	Additional Spoil Area	50 x 175	0.20	PEM
Clatsop	6.8	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	6.9	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	7.6	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	7.8	Wetland	Additional Spoil Area	50 x 150	0.17	IF
Clatsop	8.0	Wetland	Additional Spoil Area	50 x 250	0.29	IF
Clatsop	8.2	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 700	0.79	IF
Clatsop	8.7	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	8.9	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	9.3	Point of Intersection	Additional Spoil Area	50 x 100	0.15	IF
Clatsop	9.6	Point of Intersection	Additional Spoil Area	50 x 100	0.15	IF
Clatsop	9.9	Stream	Additional Spoil Area/Staging Area	50 x 60	0.07	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	10.0	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	10.0	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	10.1	Wetland	Additional Spoil Area	50 x 500	0.59	IF
Clatsop	10.3	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	10.7	Point of Intersection	Additional Spoil Area	50 x 100	0.15	IF
Clatsop	10.9	Lewis and Clark River	HDD Equipment Pad	80 x 300	0.63	PEM
					0.01	ROW
Clatsop	11.2	Lewis and Clark River	HDD Equipment Pad	80 x 300	0.33	AG
					0.01	IF
					0.02	RE
					0.32	UF
Clatsop	12.2	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	12.4	Wetland	Additional Spoil Area	50 x 205	0.24	IF
Clatsop	12.5	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 385	0.44	IF
Clatsop	12.6	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 110	0.13	IF
Clatsop	12.7	Stream	Additional Spoil Area/Staging Area	50 x 400	0.48	IF
Clatsop	12.8	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	13.1	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	13.3	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	13.6	Point of Intersection	Additional Spoil Area	50 x 260	0.26	IF
Clatsop	13.8	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	13.8	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	14.0	Point of Intersection	Additional Spoil Area	50 x 100	0.13	IF
Clatsop	14.1	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	14.1	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	14.2	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	14.2	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	14.3	Point of Intersection	Additional Spoil Area	50 x 100	0.12	IF
Clatsop	14.8	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	15.2	Steep Terrain/Stream	Additional Spoil Area/Staging Area	50 x 600	0.75	IF
Clatsop	15.4	Steep Terrain/Stream	Additional Spoil Area/Staging Area	50 x 335	0.35	IF
Clatsop	15.5	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	15.6	Stream	Additional Spoil Area/Staging Area	50 x 150	0.16	IF
Clatsop	15.7	Stream	Additional Spoil Area/Staging Area	50 x 150	0.17	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	15.8	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	16.0	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.36	IF
Clatsop	16.2	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 150	0.17	IF
Clatsop	16.4	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	16.9	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	17.3	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	17.3	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	17.4	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	17.4	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	17.6	Point of Intersection	Additional Spoil Area	50 x 100	0.13	IF
Clatsop	17.9	Stream	Additional Spoil Area/Staging Area	50 x 160	0.19	IF
Clatsop	18.2	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	18.3	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	18.3	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 175	0.20	IF
Clatsop	18.4	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 315	0.36	IF
Clatsop	18.4	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	18.6	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 150	0.17	IF
Clatsop	18.7	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	18.9	Point of Intersection	Additional Spoil Area	50 x 150	0.04	IF
					0.14	UF
Clatsop	18.9	Point of Intersection	Additional Spoil Area	50 X 90	0.10	UF
Clatsop	19.0	Wetland	Additional Spoil Area/Staging Area	50 x 80	0.04	ROW
Clatsop	19.1	Wetland	Additional Spoil Area/Staging Area	50 x 100 & 50 x 150	0.25	UP
Clatsop	19.2	Point of Intersection/Wetland	Additional Spoil Area	50 x 75 & 50 x 350	0.10	IF
					0.37	UP
					0.04	ROW
Clatsop	19.4	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 110 & 50 x 220	0.02	PEM
					0.31	IF
Clatsop	19.5	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 600	0.70	IF
Clatsop	19.6	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	19.8	Wetland	Additional Spoil Area	50 x 200	0.23	IF
Clatsop	19.8	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	20.0	Stream	Additional Spoil Area/Staging Area	50 x 300	0.35	IF
Clatsop	20.0	Stream	Additional Spoil Area/Staging Area	50 x 100	0.12	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	20.1	Stream	Additional Spoil Area/Staging Area	50 x 310	0.36	IF
Clatsop	20.2	Stream	Additional Spoil Area/Staging Area	50 x 310	0.36	IF
Clatsop	20.7	Point of Intersection	Additional Spoil Area	50 x 100	0.12	IF
Clatsop	20.8	Point of Intersection	Additional Spoil Area	50 x 100	0.12	IF
Clatsop	21.3	Stream	Additional Spoil Area/Staging Area	50 x 200	0.22	IF
Clatsop	21.5	Stream	Additional Spoil Area/Staging Area	50 x 175	0.20	IF
Clatsop	21.7	Steep Terrain	Additional Spoil Area	50 x 800	0.94	IF
Clatsop	21.9	Steep Terrain	Additional Spoil Area	50 x 390	0.44	IF
Clatsop	21.9	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 320	0.35	IF
Clatsop	22.1	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	22.2	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	22.3	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 340	0.37	IF
Clatsop	22.5	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 550	0.63	IF
Clatsop	23.0	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	23.0	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	23.4	Stream/Riparian Area	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	23.5	Stream/Riparian Area	Additional Spoil Area/Staging Area	50 x 200	0.26	IF
Clatsop	24.3	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	24.4	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 150	0.20	IF
Clatsop	24.5	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 150	0.20	IF
Clatsop	24.7	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	24.9	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 220	0.25	IF
Clatsop	25.0	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 480	0.52	IF
Clatsop	25.2	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 125	0.15	IF
Clatsop	25.3	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 225	0.27	IF
Clatsop	25.3	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 175	0.22	IF
Clatsop	25.4	Stream	Additional Spoil Area/Staging Area	50 x 125	0.15	IF
Clatsop	25.4	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	25.5	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	25.6	Point of Intersection	Additional Spoil Area	50 x 100	0.13	IF
Clatsop	25.6	Stream	Additional Spoil Area/Staging Area	50 x 240	0.29	IF
Clatsop	25.6	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	25.8	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	26	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	26.1	Point of Intersection	Additional Spoil Area	50 x 125	0.16	IF
Clatsop	26.2	Point of Intersection	Additional Spoil Area	50 x 125	0.15	IF
Clatsop	26.3	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	26.3	Stream	Additional Spoil Area/Staging Area	50 x 95	0.11	IF
Clatsop	26.4	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	26.5	Steep	Additional Spoil Area/Staging Area	50 x 580	0.68	IF
Clatsop	26.7	Stream	Additional Spoil Area/Staging Area	50 x 120	0.15	IF
Clatsop	26.7	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 700	0.82	IF
Clatsop	26.9	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	26.9	Stream	Additional Spoil Area/Staging Area	50 x 200	0.23	IF
Clatsop	27.1	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	27.2	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	27.3	Stream	Additional Spoil Area/Staging Area	50 x 170	0.19	IF
Clatsop	27.4	Stream	Additional Spoil Area/Staging Area	50 x 220	0.25	IF
Clatsop	27.9	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	28.1	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	28.1	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	28.3	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	28.7	Point of Intersection	Additional Spoil Area	50 x 100	0.15	IF
Clatsop	29	Point of Intersection	Additional Spoil Area	50 x 100	0.13	IF
Clatsop	29.4	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 140	0.18	IF
Clatsop	29.6	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	29.6	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	29.6	Point of Intersection	Additional Spoil Area	50 x 100	0.13	IF
Clatsop	30.1	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	30.1	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	30.5	Point of Intersection	Additional Spoil Area	50 x 100	0.13	IF
Clatsop	30.8	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	31.3	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 420	0.48	IF
Clatsop	31.4	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 320	0.38	IF
Clatsop	31.4	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	31.6	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 450	0.40	IF
Clatsop	31.7	Point of Intersection/Stream	Additional Spoil Area/Staging Area	50 x 375	0.43	IF
Clatsop	32.9	Point of Intersection	Additional Spoil Area	50 x 125	0.16	IF
Clatsop	33.3	Nehalem River	HDD Equipment Pad	80 x 300	0.66	UF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	33.7	Nehalem River	HDD Equipment Pad/Pullback	80 x 300 & 75 x 625	1.85	AG
Clatsop	33.9	Point of Intersection	Additional Spoil Area/Staging Area	50 x 100	0.05	AG
					0.16	AW
Clatsop	33.9	Point of Intersection	Additional Spoil Area/Staging Area	50 x 100	0.11	AG
					0.10	AW
Clatsop	34.0	Point of Intersection	Additional Spoil Area/Staging Area	50 x 100	0.21	AW
					0.01	ROW
Clatsop	34.0	Point of Intersection	Additional Spoil Area/Staging Area	50 x 100	0.08	AG
					0.11	AW
					0.02	ROW
Clatsop	34.4	Stream	Additional Spoil Area/Staging Area	50 x 150	0.17	UF
Clatsop	34.5	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 100	0.14	UF
Clatsop	35.2	Point of Intersection	Additional Spoil Area	50 x 110	0.13	UF
Clatsop	35.2	Point of Intersection	Additional Spoil Area	50 x 125	0.14	UF
Clatsop	35.3	Point of Intersection	Additional Spoil Area	50 x 110	0.13	UF
Clatsop	36.3	Wetland	Additional Spoil Area	50 x 150	0.03	PSS
					0.14	UF
Clatsop	36.4	Wetland	Additional Spoil Area/Staging Area	50 x 150	0.11	PSS
					0.06	UF
Clatsop	36.9	Steep Terrain/Wetland	Additional Spoil Area	50 x 100	0.03	PSS
					0.09	UF
Clatsop	37.1	Wetland	Additional Spoil Area	50 x 300	0.34	UF
Clatsop	37.4	Steep Terrain/Point of Intersection	Additional Spoil Area	50 x 1325	1.50	UF
Clatsop	37.4	Stream	Additional Spoil Area/Staging Area	50 x 300	0.33	UF
Clatsop	37.6	Stream	Additional Spoil Area/Staging Area	50 x 100	0.12	PEM
					0.02	IF
Clatsop	37.8	Steep Terrain	Additional Spoil Area	50 x 1460	1.67	IF
Clatsop	38.3	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	38.4	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 200	0.26	IF
Clatsop	38.6	Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	IF
Clatsop	39.2	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	39.4	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	39.4	Point of Intersection	Additional Spoil Area	50 x 100	0.14	IF
Clatsop	39.7	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	40.1	Steep Terrain/Point of Intersection	Additional Staging Area	50 x 2500	2.59	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Clatsop	40.5	Point of Intersection	Additional Spoil Area/Staging Area	50 x 1500	1.88	UF
Clatsop	40.8	Point of Intersection	Additional Spoil Area	50 x 100	0.14	UF
Clatsop	40.9	Steep Terrain	Additional Spoil Area	150 x 175	0.68	IF
					0.001	PSS
Clatsop	40.9	Steep Terrain	Additional Spoil Area	50 x 100	0.12	IF
Clatsop	41.3	Highway 26 Crossing	HDD Exit	50 x 400	0.47	UF
Clatsop	41.4	Highway 26 Crossing	HDD Pullback	80 x 1850	3.46	UF
Clatsop	41.5	Wetland	Additional Spoil Area	50 x 260	0.30	UF
Clatsop	41.6	Wetland	Additional Spoil Area	50 x 500	0.57	UF
Clatsop	41.8	Wetland	Additional Spoil Area	50 x 300	0.36	IF
Clatsop	41.9	Wetland	Additional Spoil Area	50 x 300	0.34	IF
Clatsop	42.2	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 425	0.48	IF
Clatsop	42.2	Point of Intersection/Wetland	Additional Spoil Area/Staging Area	50 x 100	0.13	IF
Clatsop	42.4	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 150	0.17	IF
Clatsop	42.4	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 150	0.17	IF
Clatsop	42.6	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	42.7	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	IF
Clatsop	43.1	Point of Intersection	Additional Spoil Area/Staging Area	100 x 300	0.92	IF
Clatsop	43.6	Hwy 26	HDD Equipment Pad	80 x 300	0.63	UF
Clatsop	43.7	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	UF
Clatsop	43.8	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	UF
Clatsop	44	Point of Intersection	Additional Spoil Area	50 x 100	0.12	UF
Tillamook	44.1	Wetland/Stream	Additional Spoil Area/Staging Area	50 x 300	0.34	UF
Tillamook	44.2	Point of Intersection	Additional Spoil Area	50 x 100	0.12	UF
Tillamook	44.5	Point of Intersection	Additional Spoil Area	50 x 100	0.13	UF
Tillamook	44.7	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	UF
Tillamook	44.8	Stream	Additional Spoil Area/Staging Area	50 x 100	0.11	UF
Tillamook	45.6	Wetland	Additional Spoil Area	50 x 200	0.23	UF
Tillamook	45.7	Point of Intersection	Additional Spoil Area	50 x 100	0.14	UF
Tillamook	45.8	Point of Intersection	Additional Spoil Area	50 x 100	0.04	IF
					0.09	UF
Tillamook	46.4	Point of Intersection	Additional Spoil Area	50 x 100	0.11	UF
Tillamook	46.7	Point of Intersection	Additional Spoil Area	50 x 100	0.12	UF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Tillamook	47.3	Wetland	Additional Spoil Area	100 X 50	0.11	UF
Columbia	47.7	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	47.9	Steep Terrain	Additional Cut/Fill Area	100 x 50	0.11	IF
Columbia	48.0	Steep Terrain	Additional Cut/Fill Area	100 x 50	0.10	IF
Columbia	48.2	Point of Intersection/Road Crossing	Additional Spoil Area/Staging Area	350 x 50 & 200 x 50	0.59	IF
Columbia	48.3	Steep Terrain/Wetland	Additional Cut/Fill Area	200 x 50	0.23	IF
Columbia	48.9	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	49.1	Steep Terrain	Additional Spoil Area	400 x 50	0.46	IF
Columbia	49.2	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	49.4	Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.11	IF
Columbia	49.5	Steep Terrain	Additional Cut/Fill Area	450 x 50	0.52	IF
Columbia	49.7	Steep Terrain	Additional Cut/Fill Area	900 x 50	1.03	IF
Columbia	49.9	Point of Intersection	Additional Spoil Area	100 x 50	0.08	IF
Columbia	50.1	POI/Steep Terrain	Additional Cut/Fill Area	1100 x 50	1.28	IF
Columbia	50.3	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	50.4	Point of Intersection	Additional Spoil Area	140 x 50	0.14	IF
Columbia	50.4	Point of Intersection	Additional Spoil Area	100 X 50	0.11	IF
Columbia	50.5	Stream Crossing	Additional Spoil Area/Staging Area	100 x 50	0.09	IF
Columbia	50.6	Wetland	Additional Spoil Area/Staging Area	100 x 50	0.10	IF
Columbia	50.8	Steep Terrain/Wetland	Additional Cut/Fill Area	100 x 50	0.08	IF
Columbia	50.9	Point of Intersection	Additional Spoil Area	150 x 50	0.20	IF
Columbia	51.6	Stream Crossing	Additional Spoil Area/Staging Area	1400 x 50	1.61	IF
Columbia	51.8	Steep Terrain	Additional Cut/Fill Area	100 x 50	0.09	IF
Columbia	51.9	Point of Intersection	Additional Spoil Area	800 x 50	0.92	IF
Columbia	51.9	Point of Intersection	Additional Spoil Area	100 x 50	0.13	IF
Columbia	52.1	Steep Terrain	Additional Cut/Fill Area	800 x 50	0.90	IF
Columbia	52.7	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	52.9	Steep Terrain	Additional Cut/Fill Area	800 x 50	0.92	IF
Columbia	53.1	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	53.3	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	53.4	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	53.5	Steep Terrain	Additional Cut/Fill Area	500 x 50	0.57	IF
Columbia	53.6	Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.12	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Columbia	53.6	Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.12	IF
Columbia	53.8	Steep Terrain	Additional Cut/Fill Area	1480 x 50	1.71	IF
Columbia	54.3	Steep Terrain	Additional Cut/Fill Area	1200 x 50	1.40	IF
Columbia	55.4	Wetland	Additional Spoil Area	100 x 50	0.12	IF
Columbia	55.4	Wetland	Additional Spoil Area	100 x 50	0.12	IF
Columbia	55.7	Wetland	Additional Spoil Area	100 x 50	0.06	IF
					0.06	PEM
Columbia	55.8	Wetland	Additional Spoil Area	100 x 50	0.11	IF
					0.01	PEM
Columbia	55.9	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.14	IF
Columbia	55.9	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.14	IF
Columbia	56.6	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.10	IF
Columbia	57.1	Rock Creek	HDD Pullback	775 x 75	1.29	IF
Columbia	57.3	Rock Creek	HDD Pullback	1926 x 75	3.43	IF
Columbia	57.4	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	57.5	Steep Terrain	Additional Cut/Fill Area	300 x 80	0.55	IF
Columbia	58.1	Rock creek	HDD Entry	300 x 80	0.55	IF
Columbia	58.4	Steep Terrain	Additional Cut/Fill Area	1045 x 50	1.19	IF
Columbia	58.5	Point of Intersection	Additional Spoil Area	100 x 50	0.18	IF
Columbia	58.7	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	58.8	Point of Intersection	Additional Spoil Area	100 x 50	0.13	IF
Columbia	59.0	Point of Intersection	Additional Spoil Area	100 x 50	0.15	IF
Columbia	59.1	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	59.2	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	59.9	Point of Intersection	Additional Spoil Area	100 x 50	0.09	IF
Columbia	60.1	Point of Intersection	Additional Spoil Area	100 x 50	0.13	IF
Columbia	60.4	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	61.3	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	61.7	Steep Terrain/Road Crossing	Additional Cut/Fill Area	100 x 50	0.13	IF
Columbia	61.7	Stream Crossing/Road Crossing	Additional Cut/Fill Area	600 x 500	0.13	IF
Columbia	62.1	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	62.2	Steep Terrain/Road Crossing	Additional Cut/Fill Area	1000 x 50	1.15	IF
Columbia	62.3	Steep Terrain/Road Crossing	Additional Cut/Fill Area	950 x 50	1.09	IF
Columbia	62.4	Steep Terrain	Additional Cut/Fill Area	250 x 170	0.57	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Columbia	62.7	Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.11	IF
Columbia	62.8	Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.11	IF
Columbia	63.0	Point of Intersection	Additional Spoil Area	100 x 50	0.09	IF
Columbia	63.1	Steep Terrain	Additional Cut/Fill Area	350 x 120	0.96	IF
Columbia	63.6	Nehalem River Crossing	HDD Entry/Equipment Pad	300 x 80	0.32	IF
					0.23	PEM
Columbia	64.3	Nehalem River Crossing	HDD Exit/Equipment Pad	300 x 80	0.55	IF
Columbia	64.3	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	64.7	Nehalem River Crossing	HDD Pullback	2470 x 75	4.56	IF
Columbia	64.8	Point of Intersection	Additional Spoil Area	100 x 50	0.13	IF
Columbia	64.9	Steep Terrain	Additional Cut/Fill Area	100 x 50	0.12	IF
Columbia	65.2	Steep Terrain	Additional Cut/Fill Area	708 x 50	0.83	IF
Columbia	65.6	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	65.7	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	66.5	Steep Terrain	Additional Cut/Fill Area	520 x 50	0.61	IF
Columbia	67.2	Steep Terrain	Additional Cut/Fill Area	670 x 50	0.77	IF
Columbia	68.0	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	68.3	POI/Steep Terrain	Additional Cut/Fill Area	250 x 50	0.31	IF
Columbia	68.7	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	69.5	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	69.7	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	70.4	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	70.6	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	70.6	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	70.7	Wetland	Additional Spoil Area	100 x 50	0.12	IF
Columbia	70.7	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	70.7	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	70.9	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	71.1	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	71.6	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.12	IF
Columbia	71.7	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	72.1	Point of Intersection	Additional Spoil Area	100 x 50	0.13	IF
Columbia	72.8	Point of Intersection	Additional Spoil Area	100 x 50	0.09	IF

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
Columbia	72.9	Road/Stream crossing	Additional Spoil Area/Staging Area	565 x 50	0.42	IF
					0.10	PFO
Columbia	73.4	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	73.5	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	73.9	Point of Intersection	Additional Spoil Area	100 x 50	0.15	IF
Columbia	74.8	Stream Crossing	Additional Spoil Area/Staging Area	100 x 50	0.11	IF
Columbia	75.1	Point of Intersection	Additional Spoil Area	100 x 50	0.09	IF
Columbia	75.7	Point of Intersection	Additional Spoil Area	100 x 50	0.12	IF
Columbia	76.0	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	76.3	Stream	Additional Spoil Area/Staging Area	1075 x 50	1.24	IF
Columbia	76.9	Point of Intersection	Additional Spoil Area	260 x 50	0.28	IF
Columbia	77.9	Point of Intersection	Additional Spoil Area	100 x 50	0.14	IF
Columbia	78.0	Point of Intersection	Additional Spoil Area	100 x 50	0.11	IF
Columbia	78.1	Point of Intersection	Additional Spoil Area	100 x 50	0.15	IF
Columbia	78.4	POI/Stream crossing	Additional Spoil Area/Staging Area	100 x 50	0.09	IF
Columbia	78.6	Point of Intersection	Additional Spoil Area	100 x 50	0.10	IF
Columbia	78.8	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.12	IF
Columbia	78.9	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.11	IF
Columbia	79.2	Wetland	Additional Spoil Area	100 x 50	0.11	IF
Columbia	79.8	Steep Terrain	Additional Cut/Fill Area	535 x 50	0.61	IF
Columbia	80.1	Point of Intersection	Additional Spoil Area	100 x 50	0.14	IF
Columbia	80.3	Point of Intersection	Additional Spoil Area	100 x 50	0.08	CI
Columbia	80.5	Point of Intersection	Additional Spoil Area	100 x 50	0.09	CI
Columbia	80.5	Point of Intersection	Additional Spoil Area	100 x 50	0.09	CI
Columbia	80.6	Point of Intersection	Additional Spoil Area	100 x 50	0.09	CI
Columbia	80.6	Compressor Station	Additional Staging Area	198 x 50	0.27	CI
Columbia	80.6	Compressor Station	Additional Staging Area	100 x 50	0.09	CI
Columbia	81.2	Columbia River Crossing	HDD Equipment Pad/Staging Area	3575 x 50	0.37	OS
					3.06	UF
Columbia	81.4	Columbia River Crossing	Additional Staging Area	50 x 100	0.15	FW
					0.003	UF
Columbia	81.5	Columbia River Crossing	Additional Staging Area	50 x 170	0.20	FW
					0.01	OS
Columbia	81.6	Columbia River Crossing	Additional Staging Area	50 x 856	0.56	EW

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
					0.43	FW
					0.02	OS
Columbia	81.6	Columbia River Crossing	Additional Staging Area	50 x 170	0.20	EW
					0.01	FW
Columbia	81.7	Columbia River Crossing	Additional Staging Area	50 x 138	0.06	EW
					0.10	FW
Columbia	81.7	Columbia River Crossing	Additional Staging Area	150 x 50	0.01	ROW
					0.09	EW
					0.07	FW
Columbia	81.8	Columbia River Crossing	Additional Staging Area	80 x 305	0.07	ROW
					0.50	FW
Cowlitz	82.8	Columbia River Crossing	Additional Staging Area	350 x 80	0.62	PEM
Cowlitz	82.8	Columbia River Crossing	Additional Staging Area	50 x 200	0.22	PEM
Cowlitz	82.9	Columbia River Crossing	Additional Staging Area	50 x 185	0.22	AG
Cowlitz	82.9	Columbia River Crossing	Additional Staging Area	200 x 50	0.22	AG
Cowlitz	83.2	Columbia River Crossing	Additional Spoil Area/Staging Area	200 x 50	0.23	PEM
Cowlitz	83.4	Columbia River Crossing	Additional Spoil Area/Staging Area	200 x 50	0.23	PEM
Cowlitz	84.2	POI/Road Crossing	Additional Spoil Area/Staging Area	50 x 175	0.20	AG
Cowlitz	84.3	POI/Road Crossing	Additional Spoil Area/Staging Area	50 x 175	0.20	AG
Cowlitz	84.3	Point of Intersection	Additional Staging Area	100 x 50	0.11	AG
Cowlitz	84.6	Point of Intersection	Additional Staging Area	50 x 100	0.17	AG
Cowlitz	84.8	Point of Intersection	Additional Staging Area	50 x 175	0.26	AG
Cowlitz	85.1	Point of Intersection	Additional Spoil Area	50 x 200	0.17	AG
Cowlitz	85.1	Point of Intersection	Additional Spoil Area	50 x 260	0.19	OS
					0.07	ROW
Cowlitz	85.1	Point of Intersection	Additional Spoil Area	50 x 360	0.40	AG
					0.10	ROW
Cowlitz	85.3	Point of Intersection	Additional Spoil Area	23 x 100	0.06	OS
Cowlitz	85.4	Point of Intersection	Additional Spoil Area	100 x 50	0.11	AG
Cowlitz	85.6	Point of Intersection	Additional Spoil Area	100 x 50	0.15	AG
Cowlitz	85.7	I-5	Additional Spoil Area/Staging Area	175 x 50	0.12	PEM
					0.09	OS
Cowlitz	85.7	I-5	Additional Spoil Area/Staging Area	50 x 175	0.16	PEM
					0.03	OS
Cowlitz	85.9	POI/Road Crossing	Additional Spoil Area/Staging Area	175 x 50	0.10	PEM

Table E4-1

Additional Temporary Workspace for Oregon LNG Pipeline

County	Milepost	Crossing	Description	Dimensions (feet)	Acreage	Land Use Within Additional Temporary Workspace
					0.10	RE
Cowlitz	85.9	POI/Road Crossing	Additional Spoil Area/Staging Area	50 x 143	0.20	RE
Cowlitz	86.0	POI/Road Crossing	Additional Spoil Area/Staging Area	100 x 50	0.11	UF
Cowlitz	86.1	Point of Intersection	Additional Spoil Area	50 x 175	0.26	OS
Cowlitz	86.2	Point of Intersection	Additional Spoil Area	50 x 200	0.17	OS
Cowlitz	86.4	Point of Intersection	Additional Spoil Area	50 x 200	0.18	OS
Cowlitz	86.4	Point of Intersection	Additional Spoil Area	50 x 110	0.17	OS
Cowlitz	86.5	Point of Intersection	Additional Spoil Area	50 x 112	0.01	PEM
					0.15	OS
Total for Additional Temporary Workspaces					138.90	

Abbreviations of Land Use Classifications
AG = Agriculture
AW = Agricultural Wetland
CI = Commercial/Industrial
EW = Estuarine Wetland
FW = Forested Wetland
IF = Industrial Forest
OS = Open Space
PEM = Palustrine Emergent Wetlands
PFO = Palustrine Forested Wetlands
PSS = Palustrine Scrub-Shrub Wetlands
RE = Residential
ROW = Right-of-Way
UF = Upland Forest
Precision loss may occur because of rounding.

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage
0.1	Clatsop	Slough/Waterbody	50 x 100	W5BCL020	OS, EM	9.5	Additional Spoil Area/Staging Area	0.12
				W5BCL058		0		
0.2	Clatsop	Point of Intersection	407 x 123	W5BCL021	EW, OS	0	Additional Spoils Area	1.24
				W5BCL052		0		
0.6	Clatsop	Slough/Waterbody	175 x 50	W99CL0021	EW	0	Additional Spoil Area/ Staging Area	0.20
0.6	Clatsop	Slough/Waterbody	175 x 100	W99CL0021	EW	0	Additional Spoil Area/ Staging Area	0.41
0.8	Clatsop	Highway 101 Crossing	512 x 50	W99CL0021	EW	0	Additional Spoil Area/ Staging Area	0.56
0.8	Clatsop	Highway 101 Crossing	373 x 117				Additional Spoil Area/ Staging Area	0.74
				W99CL0021	EW	0		
0.8	Clatsop	Highway 101 Crossing	50 x 85	W99CL0021	EW, OS	0	Additional Spoil Area/ Staging Area	0.10
1.1	Clatsop	Slough/Waterbody	535 x 180	W99CL0021A	EW	0	Additional Spoil Area/ Staging Area	1.73
1.5	Clatsop	Slough/Waterbody	50 x 200	W5BCL015O	AW	0	Additional Spoil Area/ Staging Area	0.23
1.7	Clatsop	Airport Road	50 x 175	W5BCL015O	AW	0	Bore Pit and Equipment	0.10
1.7	Clatsop	Airport Road	50 x 175	W5BCL015O	AW	0	Bore Pit and Equipment	0.08
1.7	Clatsop	Airport Road	50 x 175	W5BCL015O	AW	0	Bore Pit and Equipment	0.20
1.7	Clatsop	Airport Road	50 x 175	W5BCL060	AW	0	Bore Pit and Equipment	0.21
2.4	Clatsop	Clatsop Airport Road	50 x 200	W38CL083 W99CL202	EM, ROW, AG, PSS	0	Bore Pit and Equipment	0.25
2.4	Clatsop	Clatsop Airport Road	50 x 425	W5BCL066	EM, OS, PSS	0	Bore Pit and Equipment	0.55
				W5BCL067		0		
2.4	Clatsop	Clatsop Airport Road	50 x 175	W5BCL066	EM, PSS,	0	Bore Pit and Equipment	0.21

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage
				W5BCL067		0		
2.8	Clatsop	Lewis and Clark River	125 x 300	W40CL001	UF, PSS	0	HDD Equipment Pad	0.97
3.4	Clatsop	Lewis and Clark River	150 x 300	W40CL010	AW	0	HDD Equipment Pad/ Pullback	0.95
3.7	Clatsop	Slough/Waterbody	50 x 500	W99CL077A	AW	0	Additional Spoil Area/ Staging Area	0.57
4.0	Clatsop	Slough/Waterbody	50 x 770	W5BCL042F	AW	0	Additional Spoil Area/ Staging Area	0.88
4.1	Clatsop	Slough/Waterbody	50 x 400	W5BCL042F	AW	0	Additional Spoil Area/ Staging Area	0.46
4.2	Clatsop	Slough/Waterbody	50 x 350	S5BCL063	EM, AW	50	Additional Spoil Area/ Staging Area	0.40
				W42CL001		0		
				W5BCL042F		0		
4.4	Clatsop	Slough/Waterbody	50 x 1100	W42CL001	EM	0	Additional Spoil Area/ Staging Area	1.27
				S5BCL064		0		
4.6	Clatsop	Slough/Waterbody	50 x 125	W42CL001	EM	0	Additional Spoil Area/ Staging Area	0.14
				W5BCL042C		48		
				W5BCL043		0		
				S5BCL066		48		
4.6	Clatsop	Slough/Waterbody	50 x 175	W5BCL042C	AW	0	Additional Spoil Area/ Staging Area	0.20
4.7	Clatsop	Slough/Waterbody	50 x 150	S5BCL065	AW	48	Additional Spoil Area/Staging Area	0.17
				S5BCL068		50		
				W42CL002		0		
				W40CL016		0		
4.8	Clatsop	Slough/Waterbody	50 x 250	W40CL016	AW	0	Additional Spoil Area/ Staging Area	0.29
				S5BCL068		49		
				W42CL002		0		

2

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage
				W5BCL042C		0		
4.9	Clatsop	Slough/Waterbody	50 x 325	W39CL004	AW	0	Additional Spoil Area/ Staging Area	0.37
				W40CL016	AW	0		
				W5BCL042D	AW	0		
5.0	Clatsop	Lewis and Clark River Bank	80 x 300	W39CL004	AW	0	HDD Equipment Pad	0.55
				W40CL016				
5.4	Clatsop	Lewis and Clark River	75 x 410	S99CL034	AW, AG	0	HDD Pullback	0.70
				W40CL023				
5.5	Clatsop	Slough/Waterbody	50 x 320	W99CL074	AW	0	Additional Spoil Area/ Staging Area	0.37
				W40CL023		0		
5.5	Clatsop	Slough/Waterbody	50 x 225	W40CL023	AW	0		0.27
				W99CL074	AW	0		
5.5	Clatsop	Lewis and Clark River Bank	50 x 325 & 75 x 1300	W40CL023	AW, AG	0	HDD Equipment Pad/ Pullback/Additional Spoil Area/Staging Area	2.50
5.6	Clatsop	Lewis and Clark River	80 x 250	W99CL073	AW	0	HDD Equipment Pad	0.46
5.6	Clatsop	Slough/Waterbody	50 x 200	W99CL073	AW	0	Additional Spoil Area/ Staging Area	0.23
6.3	Clatsop	Point of Intersection	50 x 175	W38CL007B	EM	0	Additional Spoil Area	0.20
6.3	Clatsop	Point of Intersection	50 x 175	W38CL007B	EM, IF, AG	0	Additional Spoil Area	0.20
8.0	Clatsop	Wetland	50 x 250	W1BCL003	IF	50	Additional Spoil Area	0.29
10.9	Clatsop	Lewis and Clark River	80 x 300	W99CL004	EM, ROW	0	HDD Equipment Pad	0.64
				W99CL007	EM	0		
19.4	Clatsop	Wetland/Stream	50 x 110	W7BCL004	EM, IF	0	Additional Spoil Area/ Staging Area	0.13
19.4	Clatsop	Wetland/Stream	50 x 220	W7BCL004	IF, EM	0	Additional Spoil Area/ Staging Area	0.21
29.0	Clatsop	Point of Intersection	50 x 100	S5BCL001	IF	50	Additional Spoil Area	0.13

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage
33.9	Clatsop	Point of Intersection	50 x 100	W39CL014	AG, AW	0	Additional Spoil Area/ Staging Area	0.22
				W39CL015		46		
33.9	Clatsop	Point of Intersection	50 x 100	W39CL014	AG, AW	0	Additional Spoil Area/ Staging Area	0.21
				W39CL015		46		
34.0	Clatsop	Point of Intersection	50 x 100	W39CL014	AW, ROW	46	Additional Spoil Area/ Staging Area	0.21
				W39CL015		0		
34.0	Clatsop	Point of Intersection	50 x 100	W39CL014	AW, AG, ROW	46	Additional Spoil Area/ Staging Area	0.21
				W39CL015		0		
36.3	Clatsop	Wetland	50 x 150	W3BCL101	PSS, UF	0	Additional Spoil Area	0.03
				W3BCL101		0		0.14
36.4	Clatsop	Wetland	50 x 150	S3BCL102	UF, PSS	50	Additional Spoil Area/ Staging Area	0.17
				W3BCL101b		0		
				W3BCL101		0		
36.9	Clatsop	Steep Terrain/ Wetland	50 x 100	W3BCL101b	UF, PSS	0	Additional Spoil Area	0.12
37.6	Clatsop	Stream	50 x 100	W8BCL004	EM, IF	0	Additional Spoil Area/ Staging Area	0.14
40.9	Clatsop	Steep Terrain	150 x 175	W8BCL007C	IF	20	Additional Spoil Area	0.12
40.9	Clatsop	Steep Terrain	150 x 175	W8BCL007A	IF, PSS	36	Additional Spoil Area	0.68
				W8BCL007C	IF	0		
42.6	Clatsop	Wetland/Stream	50 x 100	S1BCL020	IF	50	Additional Spoil Area/ Staging Area	0.11
				W1BCL040		5034		
42.7	Clatsop	Wetland/Stream	50 x 100	S1BCL020	IF	50	Additional Spoil Area/ Staging Area	0.11
				W1BCL040	IF	34		
48.2	Columbia	Point of Intersection /Road Crossing	350 x 50 & 200 x 50	W1BCO001	IF	50	Additional Spoil Area/ Staging Area	0.59
48.3	Columbia	Steep Terrain/Wetland	200 x 50	W1BCO003	IF	40		0.23

4

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage
				S1BCO000	IF	49	Additional Spoil Area/ Staging Area	
50.6	Columbia	Wetland	100 x 50	W3BCO111	IF	0	Additional Spoil Area/ Staging Area	0.10
55.4	Columbia	Wetland	100 x 50	W3BCO109	IF	34	Additional Spoil Area	0.12
55.7	Columbia	Wetland	100 x 50	W3BCO107	EM, IF	0	Additional Spoil Area	0.12
55.8	Columbia	Wetland	100 x 50	W3BCO107	IF, EM	0	Additional Spoil Area	0.12
63.6	Columbia	Nehalem River Crossing	300 x 80	W3BCO103c W3BCO103	EM,IF	0	HDD Entry/Equipment Pad	0.55
70.7	Columbia	Wetland	100 x 50	S99CO020	IF	36	Additional Spoil Area	0.12
72.9	Columbia	Road/Stream crossing	565 x 50	W3BCO007	IF,FW		Additional Spoil Area/ Staging Area	0.52
81.2	Columbia	Columbia River Crossing	3575 x 50	W5BCO013	UF, OS	2	HDD Equipment Pad/ Staging Area	3.43
81.4	Columbia	Columbia River Crossing	50 x 100	W5BCO013	FW, UF	0	Additional Staging Area	0.16
81.5	Columbia	Columbia River Crossing	50 x 170	W5BCO013 W99CO030	FW	0	Additional Staging Area	0.21
81.6	Columbia	Columbia River Crossing	50 x 856	W99CO005 W99CO030 W99CO031 W99CO032	EM, FW, OS	0 0 0 0	Additional Staging Area	1.01
81.6	Columbia	Columbia River Crossing	50 x 170	W99CO030 W99CO031	EM, FW	0 0	Additional Staging Area	0.21
81.7	Columbia	Columbia River Crossing	50 x 138	W99CO005 W99CO030 W99CO031	EW, FW	0 0 0	Additional Staging Area	0.16

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage
81.7	Columbia	Columbia River Crossing	150 x 50	W99CO006 W99CO007 W99CO032	ROW, EM, FW	0 0 0	Additional Staging Area	0.17
81.8	Columbia	Columbia River Crossing	80 x 305	W99CO006	ROW, FW	0	Additional Staging Area	0.57
82.8	Cowlitz	Columbia River Crossing	350 x 80	W99CW001	EM	0	Additional Staging Area	0.62
82.8	Cowlitz	Columbia River Crossing	50 x 200	W99CW001	EM	0	Additional Staging Area	0.22
83.2	Cowlitz	Columbia River Crossing	200 x 50	W99CW002	EM	0	Additional Spoil Area/Staging Area	0.23
83.4	Cowlitz	Columbia River Crossing	200 x 50	W99CW002	EM	0	Additional Spoil Area/Staging Area	0.23
85.7	Cowlitz	I-5	175 x 50	W99CW022	EM, OS	0	Additional Spoil Area/Staging Area	0.21
85.7	Cowlitz	I-5	50 x 175	W99CW022	EM, OS	0	Additional Spoil Area/Staging Area	0.19
85.9	Cowlitz	POI/Road Crossing	175 x 50	W99CW022	EM, RE	0	Additional Spoil Area/Staging Area	0.20
85.9	Cowlitz	POI/Road Crossing	50 x 143	S99CW022	RE	0	Additional Spoil Area/Staging Area	0.20
86.0	Cowlitz	POI/Road Crossing	100 x 50	S99CW022	UF	0	Additional Spoil Area/Staging Area	0.11
86.4	Cowlitz	Point of Intersection	50 x 110	S99CW023	OS	0	Additional Spoil Area	0.17
86.5	Cowlitz	Point of Intersection	50 x 112	W99CW011 S99CW023	EM, OS	0	Additional Spoil Area	0.16

Notes:

AG = Agriculture
ATWS = Additional Temporary Workspaces
AW = Agricultural Wetland

6

Table E4-2: Additional Temporary Workspaces within 50 Feet of Wetlands and Waterbodies

Milepost	County	Crossing	Dimensions (feet)	Wetland Water ID	Land Use in Additional Temporary Workspaces	Distance to Wetland (feet)	Description	Additional Temporary Workspaces Acreage

EM = Emergent Wetland
EW = Estuarine Wetland
FW = Forested Wetland
IF = Industrial Forest
OS = Open Space
PSS = Palustrine Scrub-Shrub Wetland
RE = Residential
ROW = Right-of-Way
UF = Upland Forest

Precision loss may occur because of rounding.

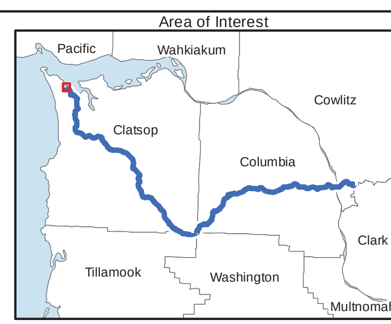
APPENDIX E5

MAPS AND TABLE OF ACCESS ROADS

LEGEND

Terminal Layout

Terminal Access Road



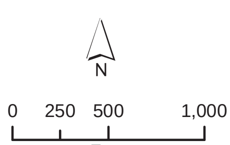


Figure 1
Access Roads for the Project

Figure 2
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

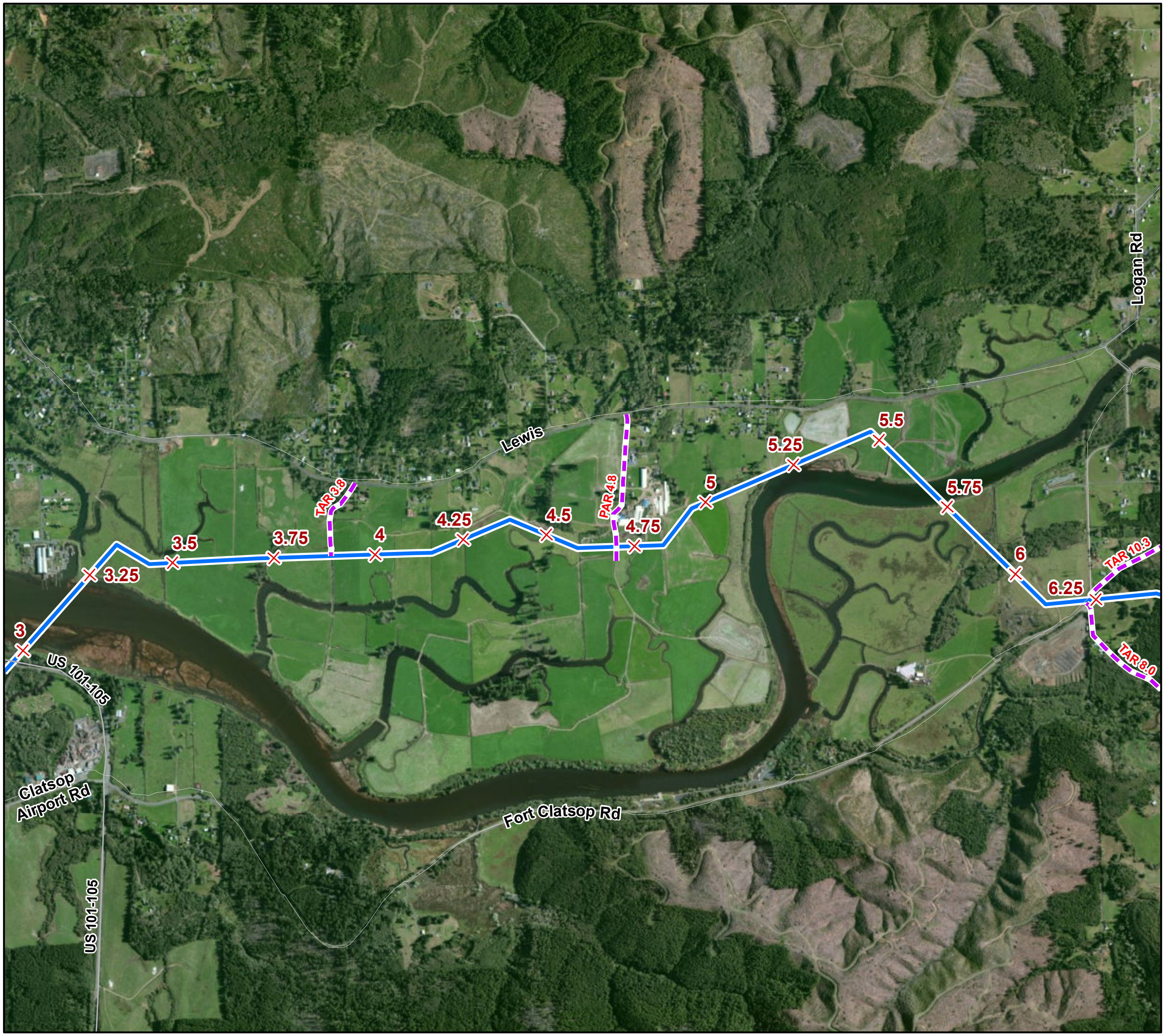
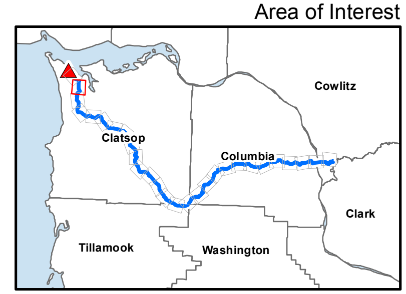


Figure 3
Access Roads for the Project

LEGEND
- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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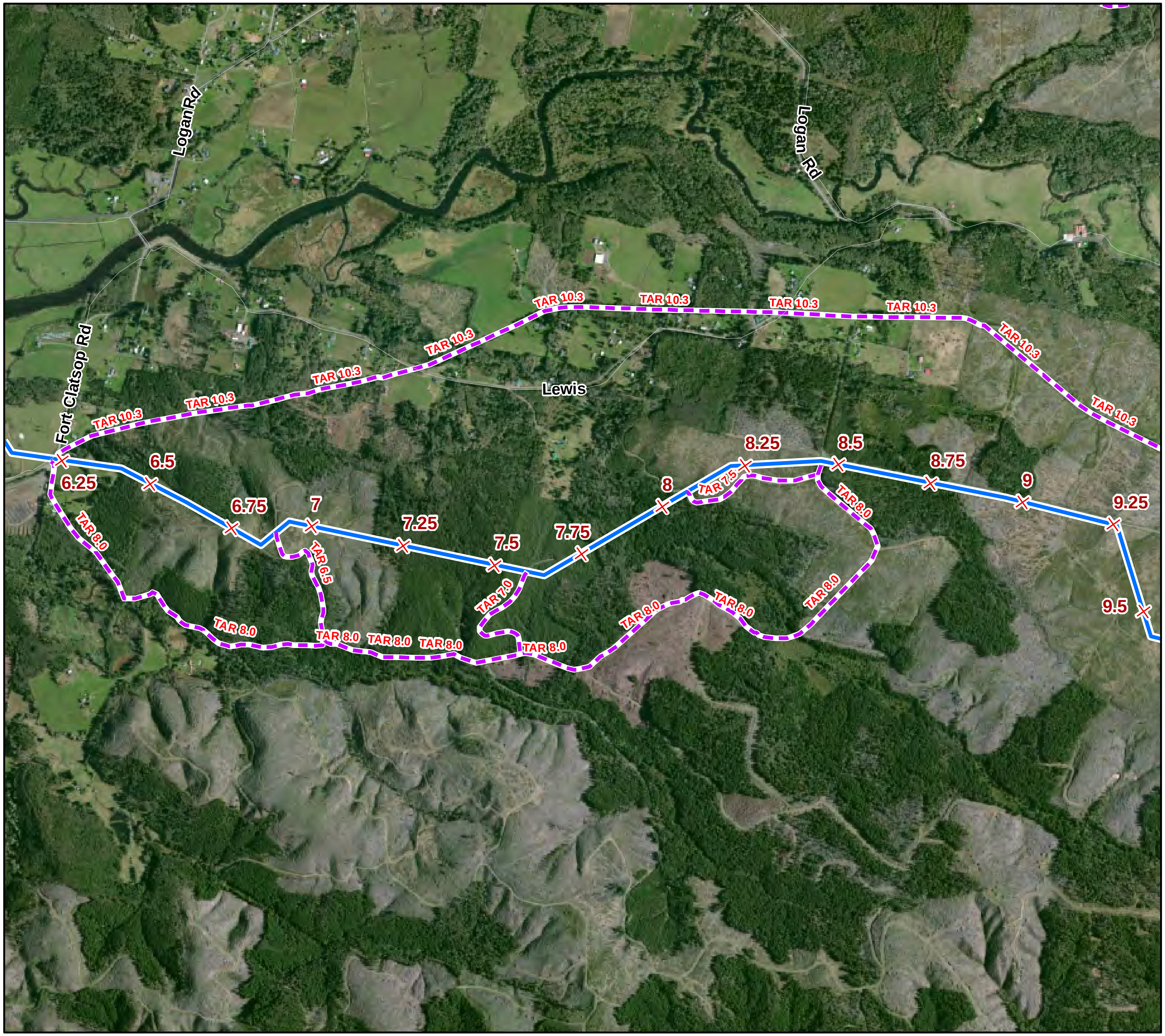
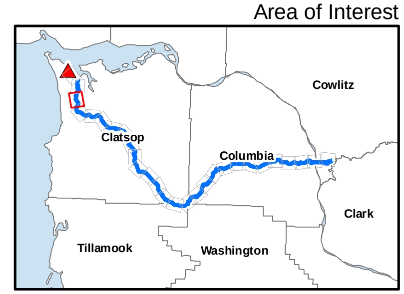


Figure 4
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road



0 1,000 2,000
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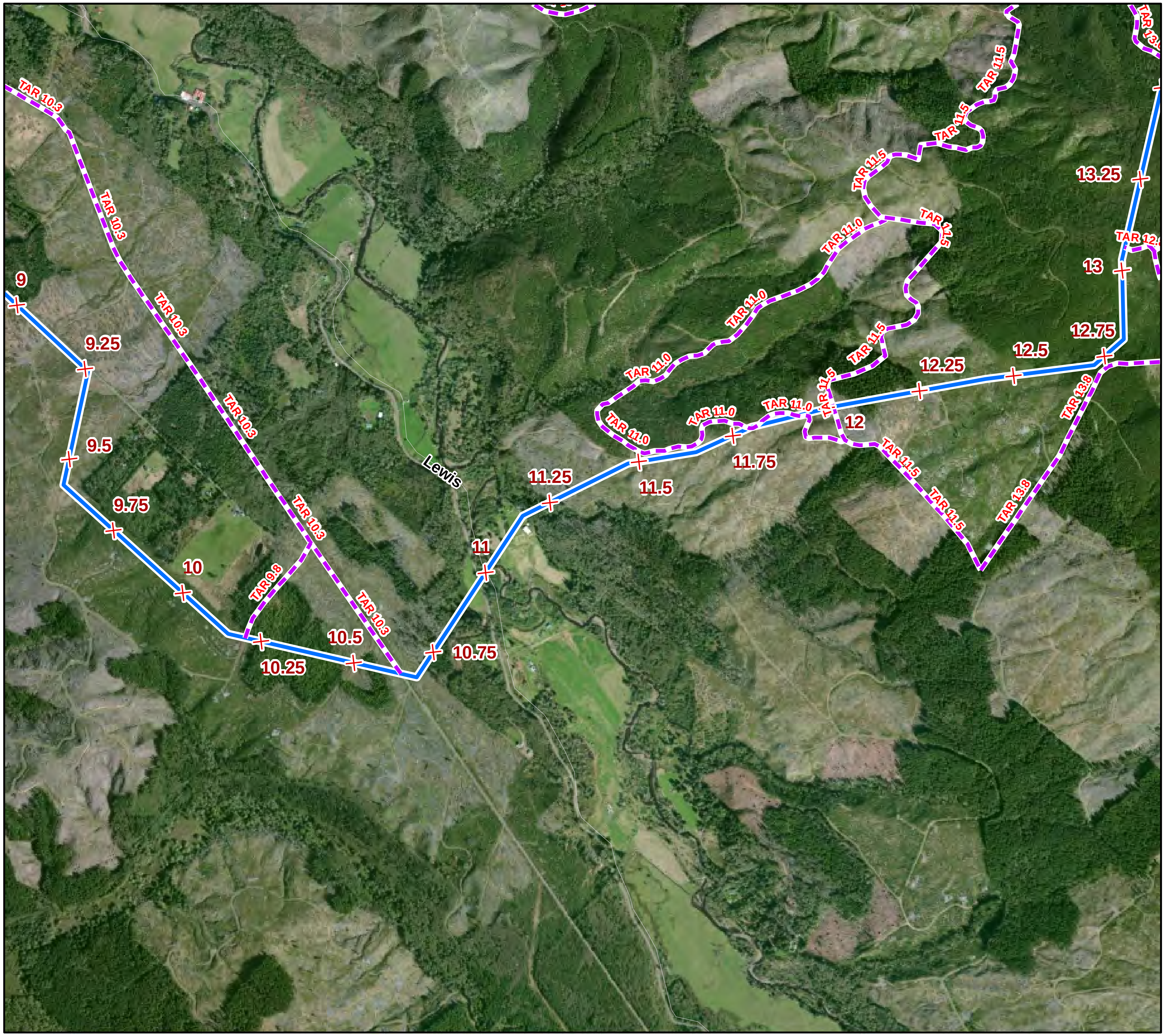
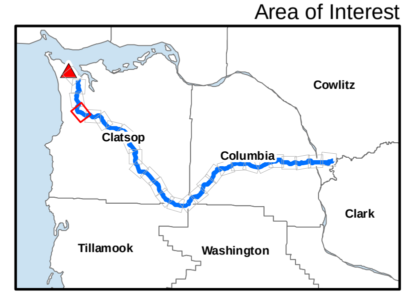


Figure 5
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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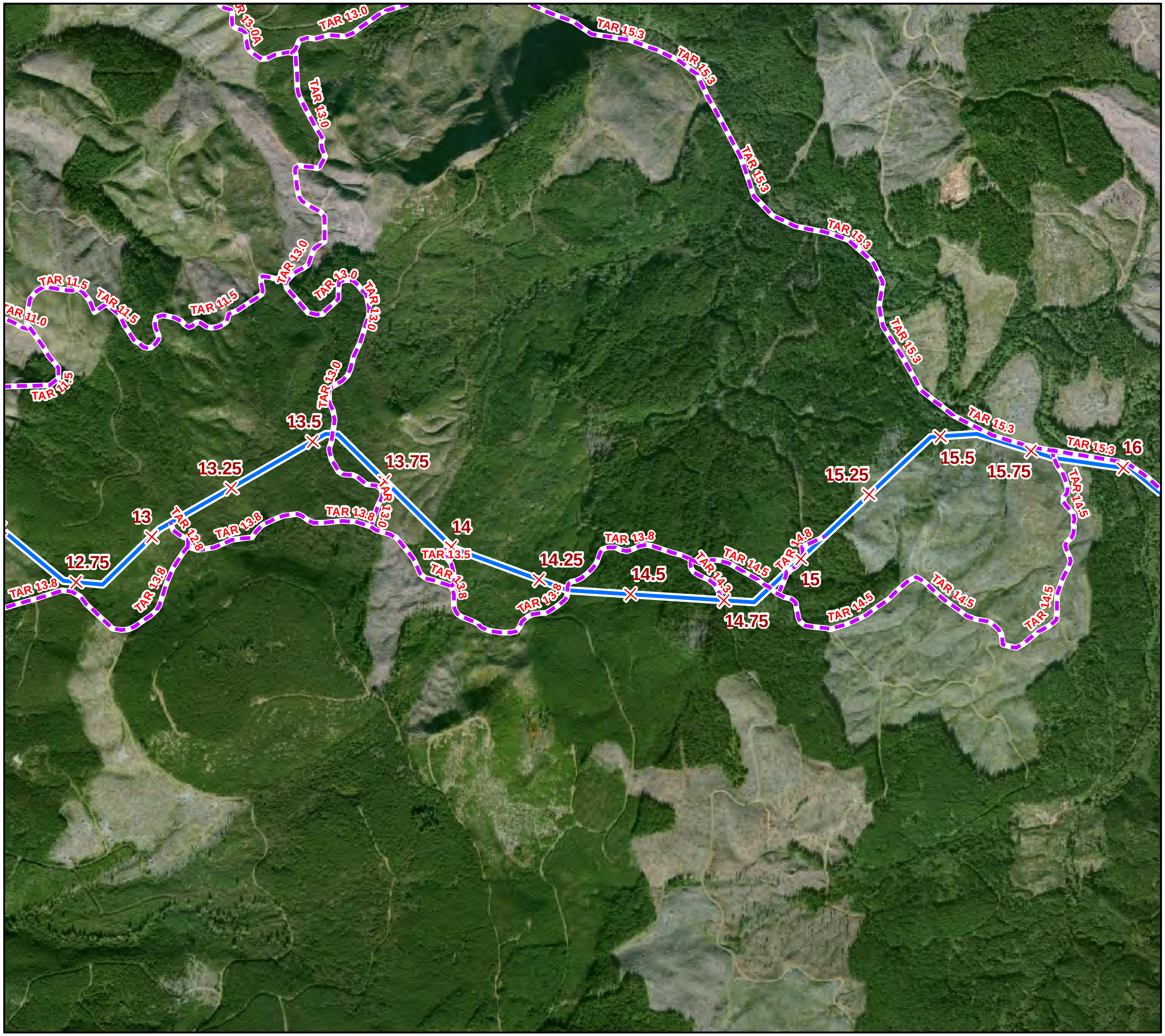
Feet

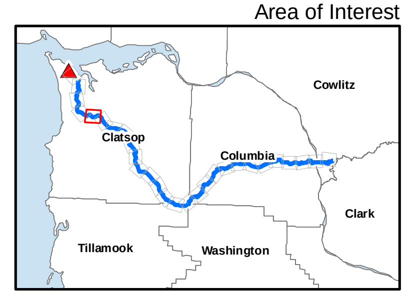
Figure 6
Access Roads for the Project



LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



N

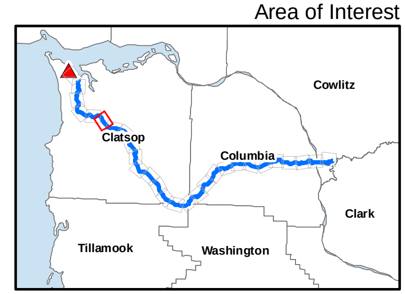
0 1,000 2,000
Feet

Figure 7
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



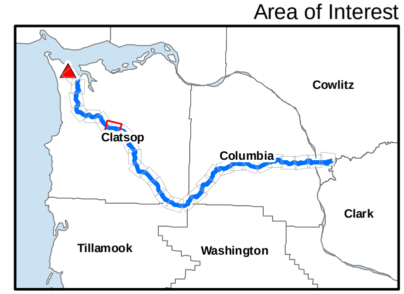
0 1,000 2,000
Feet

Figure 8
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



N

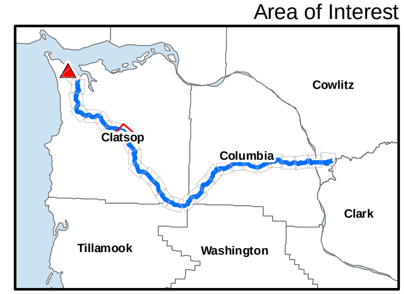
0 1,000 2,000
Feet

Figure 9
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



N

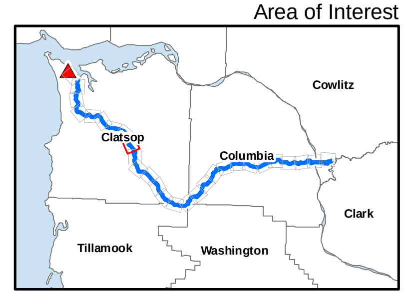
0 1,000 2,000
Feet

Figure 10
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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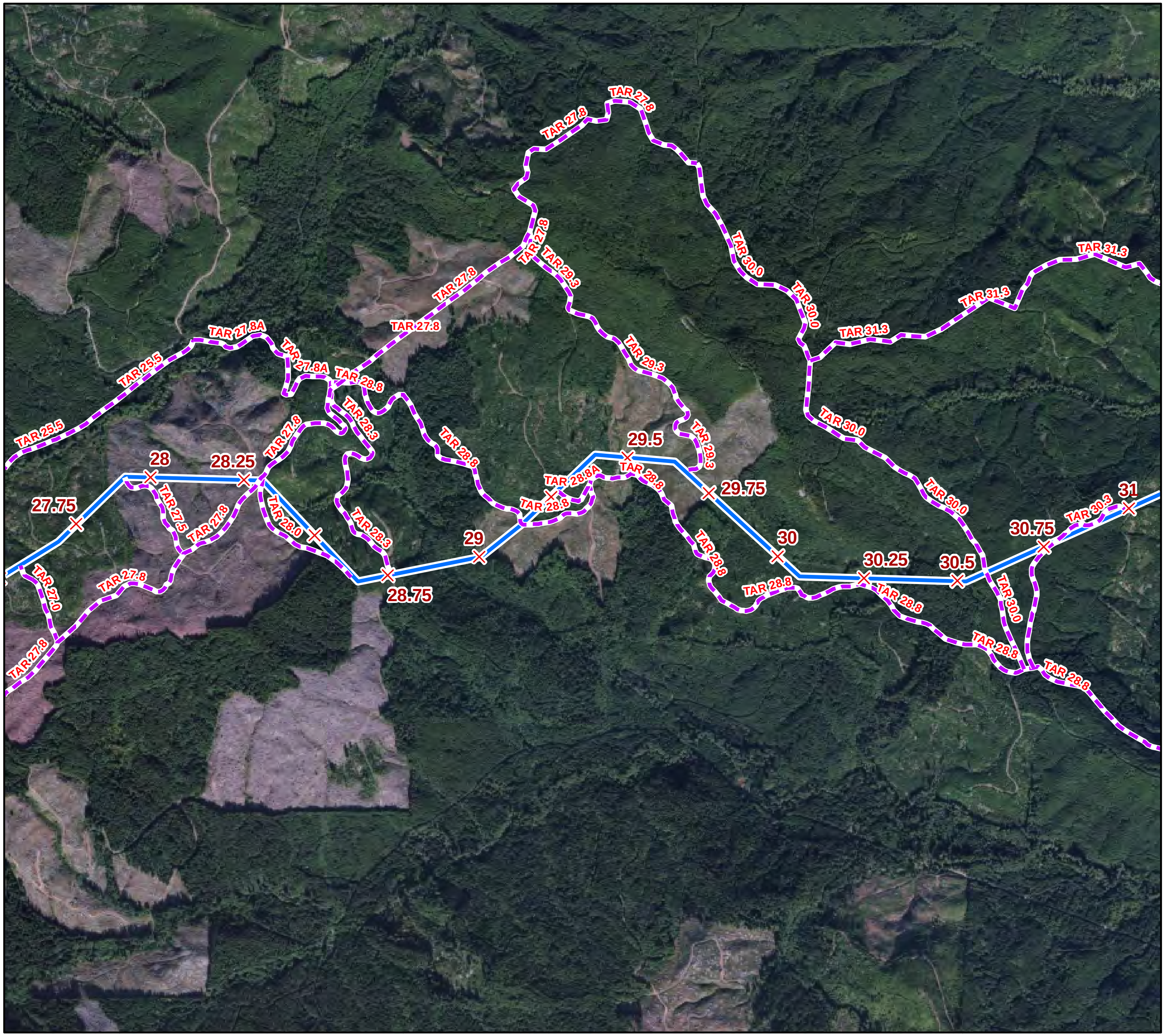
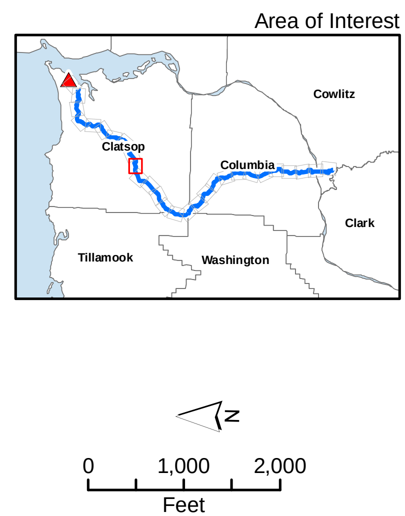


Figure 11
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road



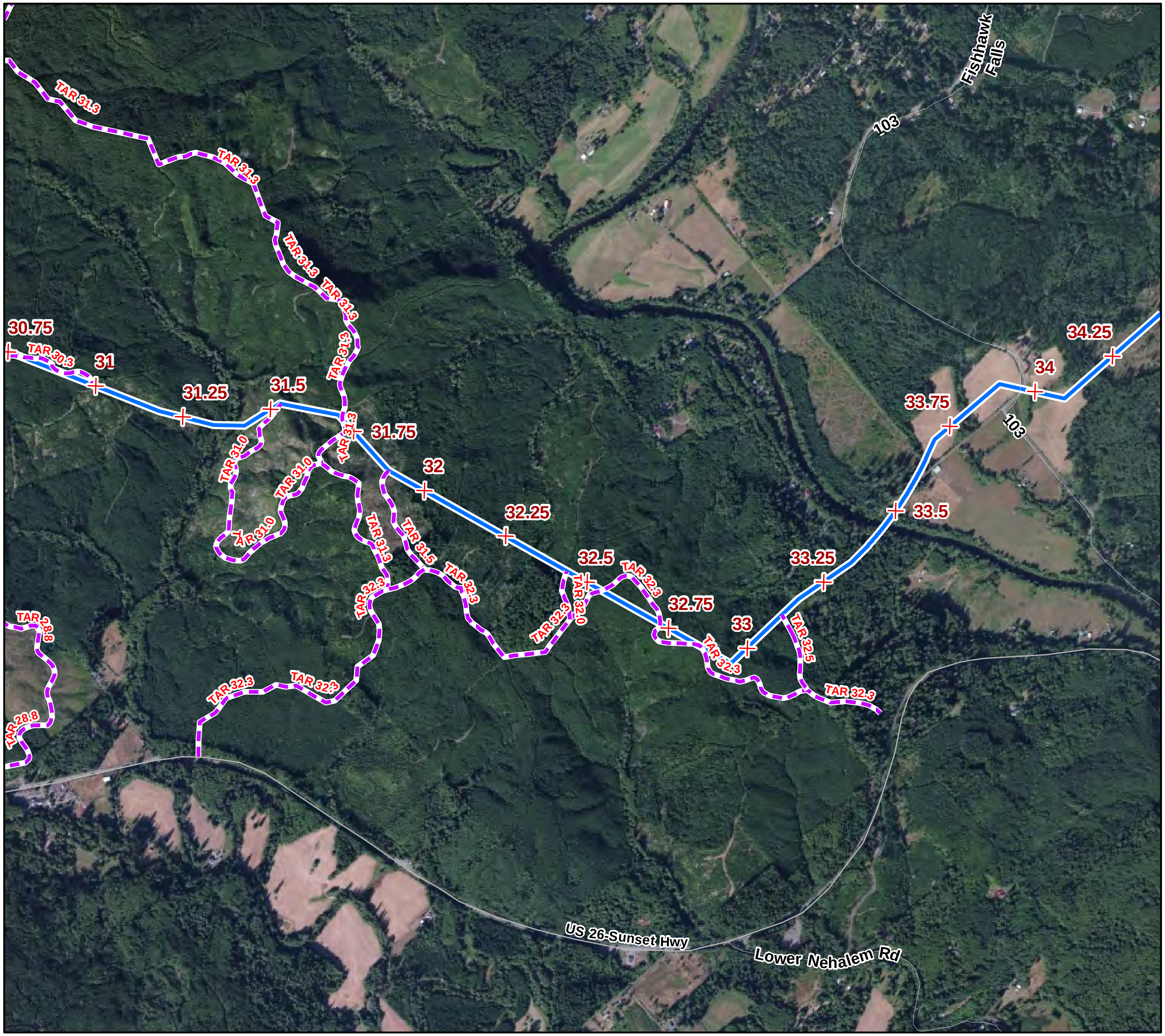
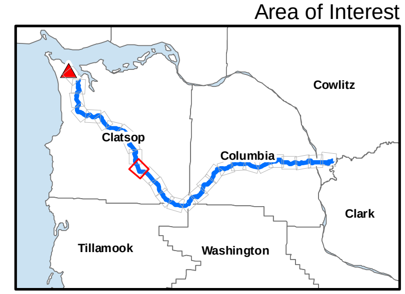


Figure 12
Access Roads for the Project

LEGEND
- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



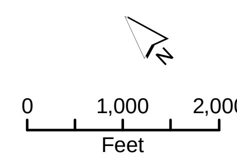
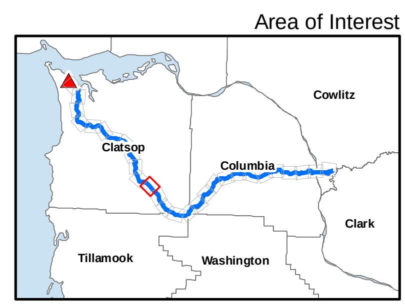


Figure 13
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road



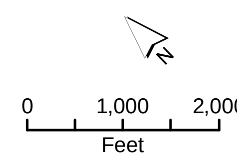
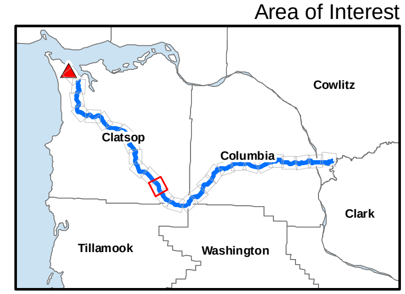


Figure 14
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road



0 1,000 2,000
Feet

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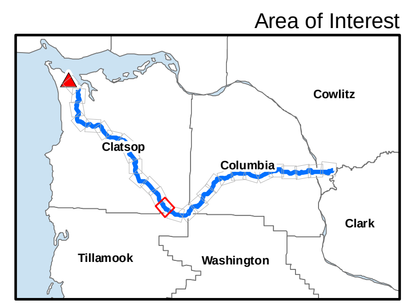
Figure 15
Access Roads for the Project

LEGEND
- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road



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Feet

Figure 16
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest

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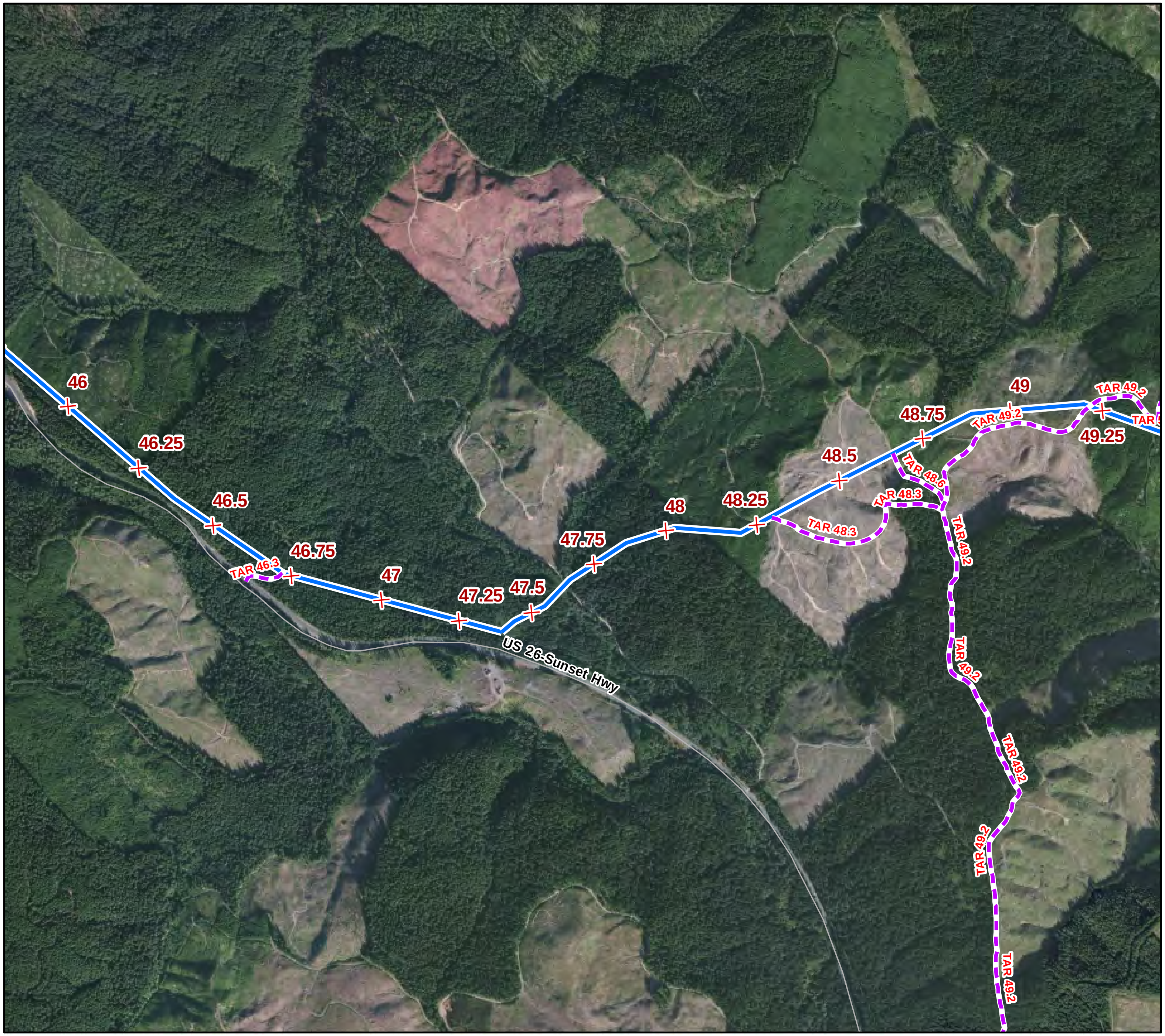
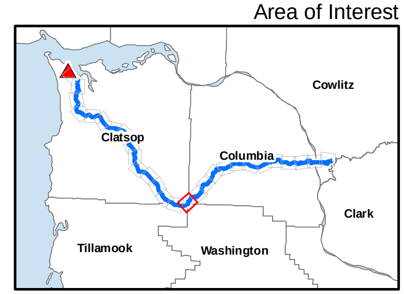
Feet

Figure 17
Access Roads for the Project



LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road



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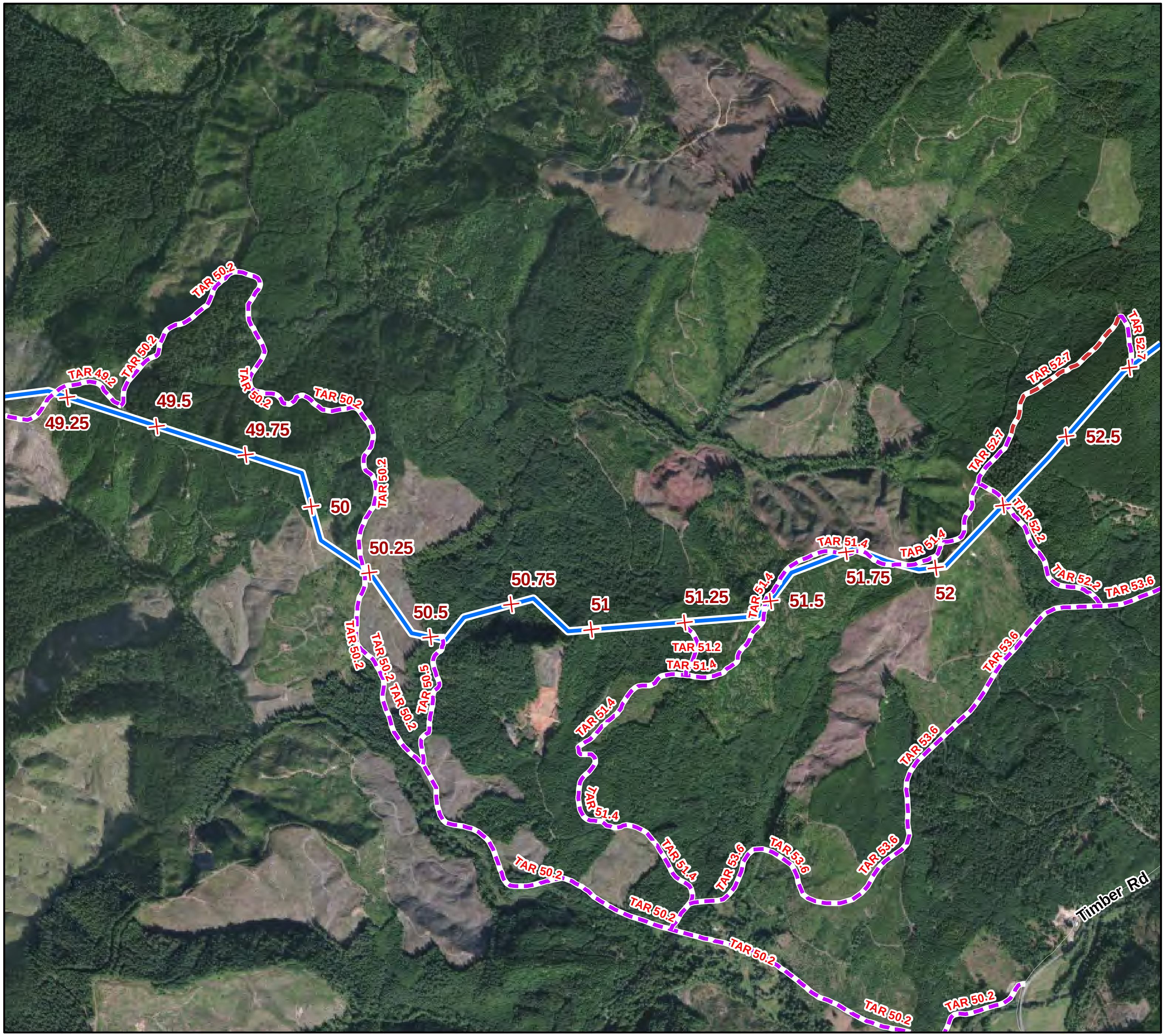
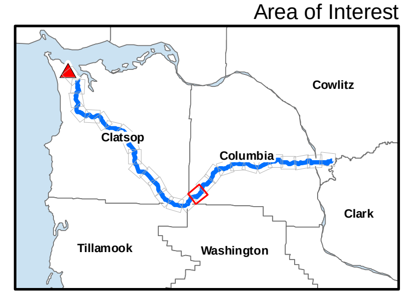


Figure 18
Access Roads for the Project

LEGEND

- × Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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Feet

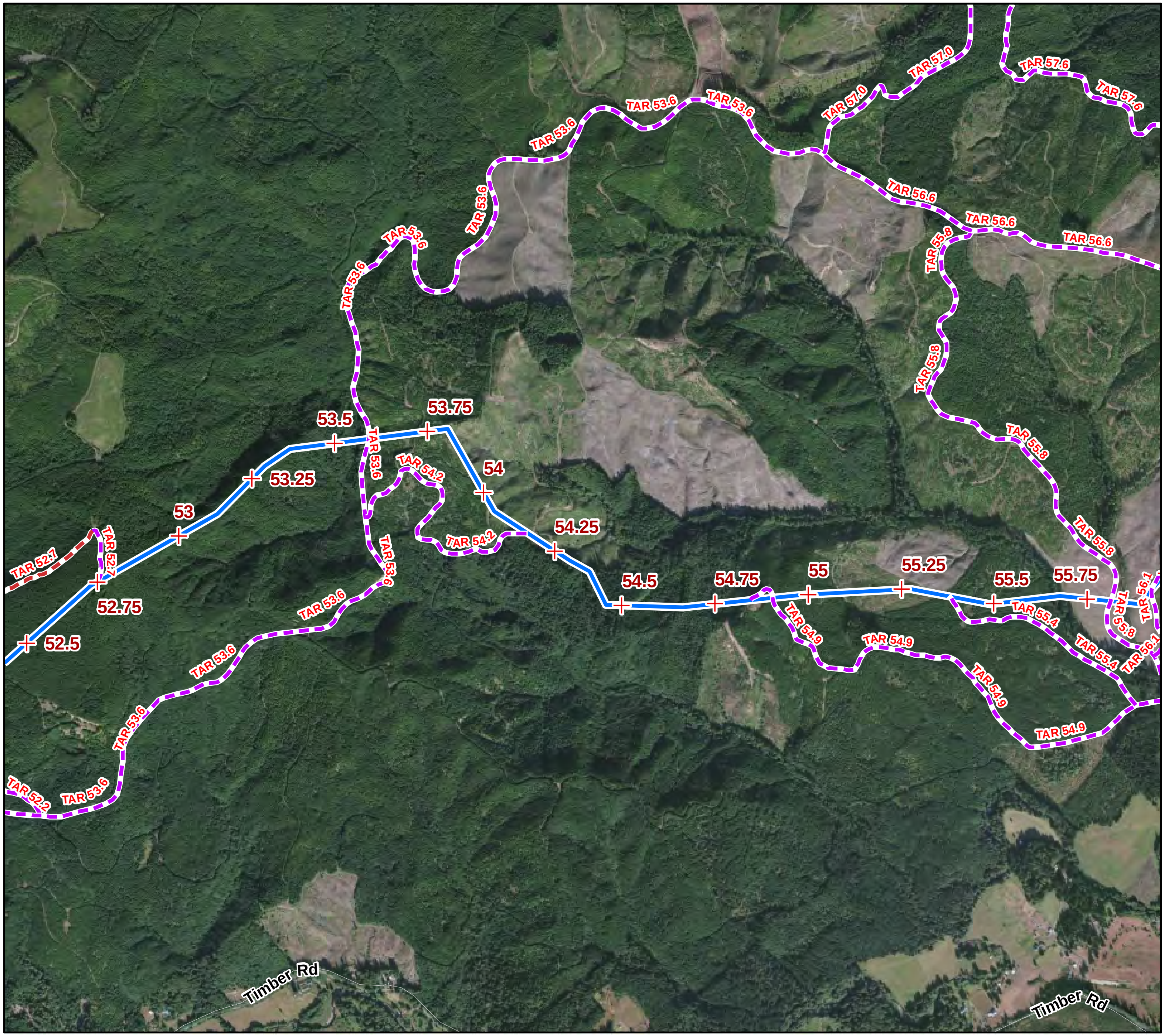
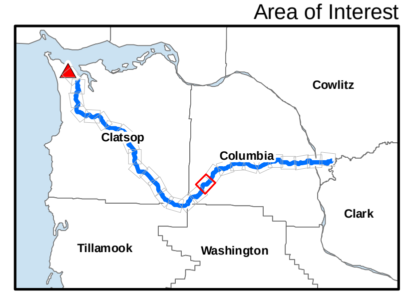


Figure 19
Access Roads for the Project

LEGEND
Pipeline Route Milepost (Qtr Mile)
Pipeline Route
New Access Road
Existing Access Road

Area of Interest



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Feet

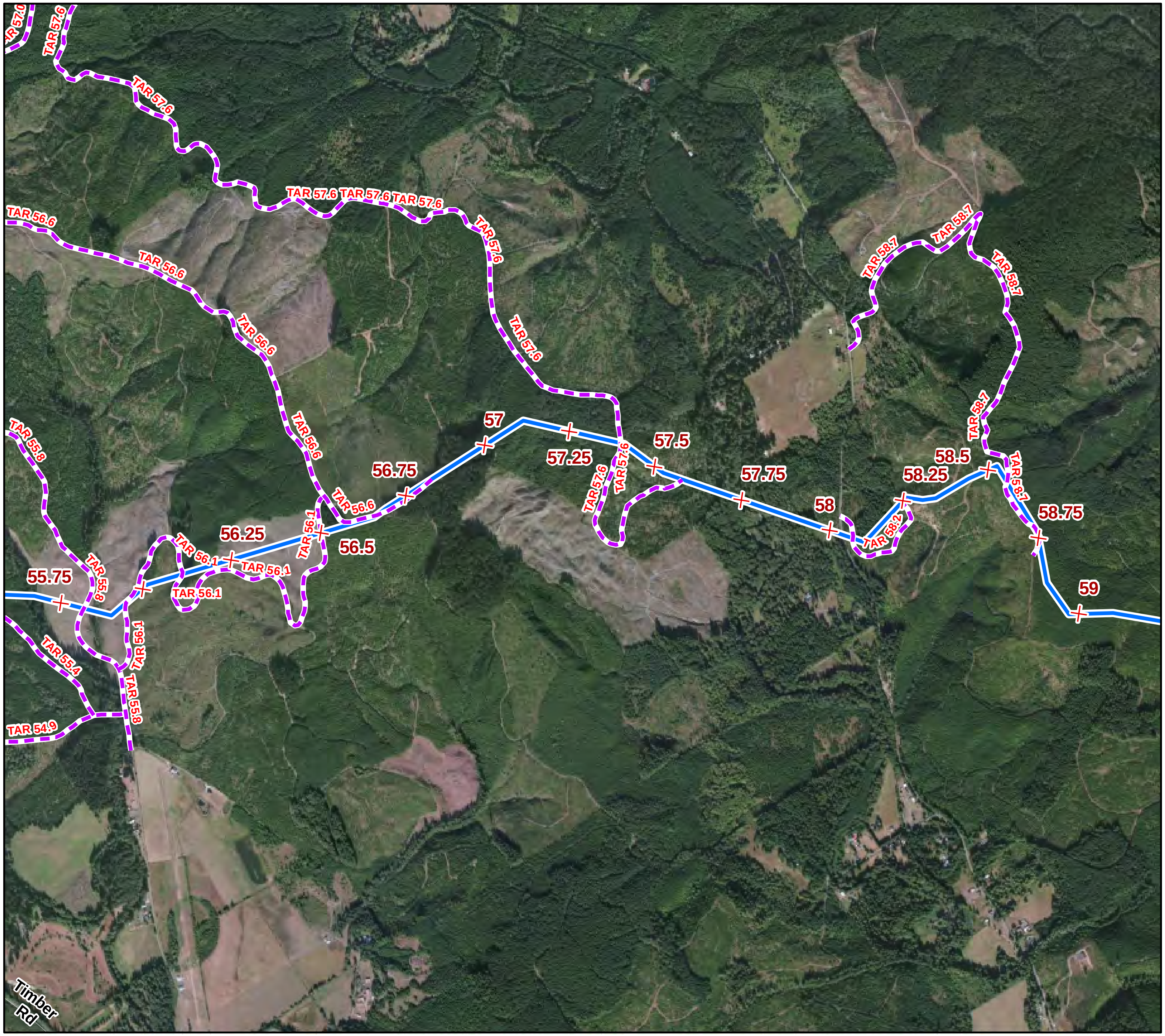
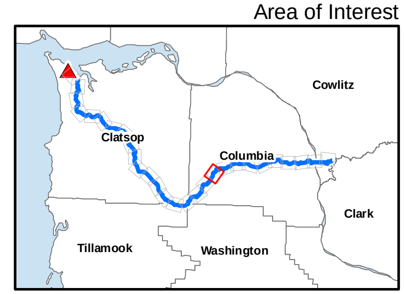


Figure 20
Access Roads for the Project

LEGEND
- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



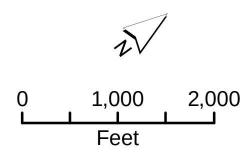
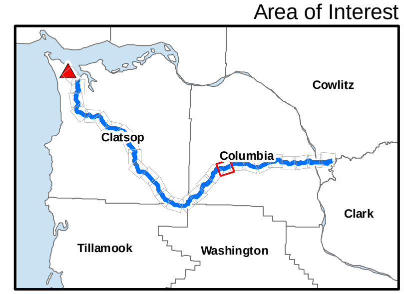


Figure 21
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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0 1,000 2,000
Feet

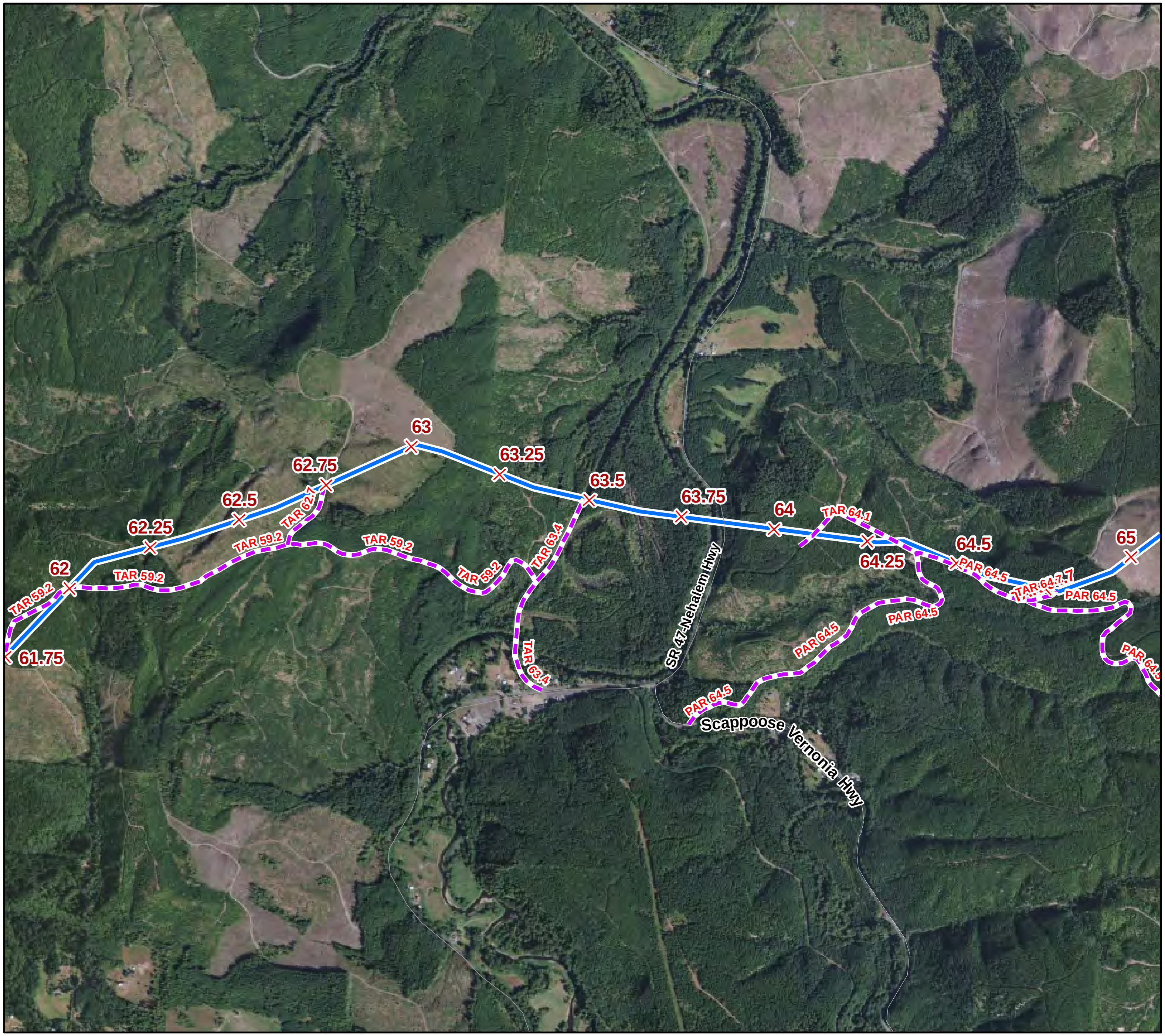
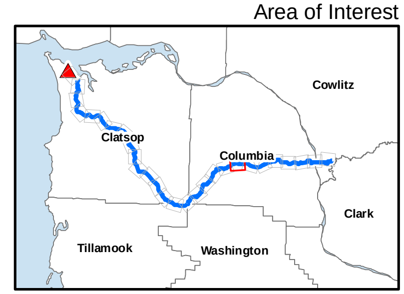


Figure 22
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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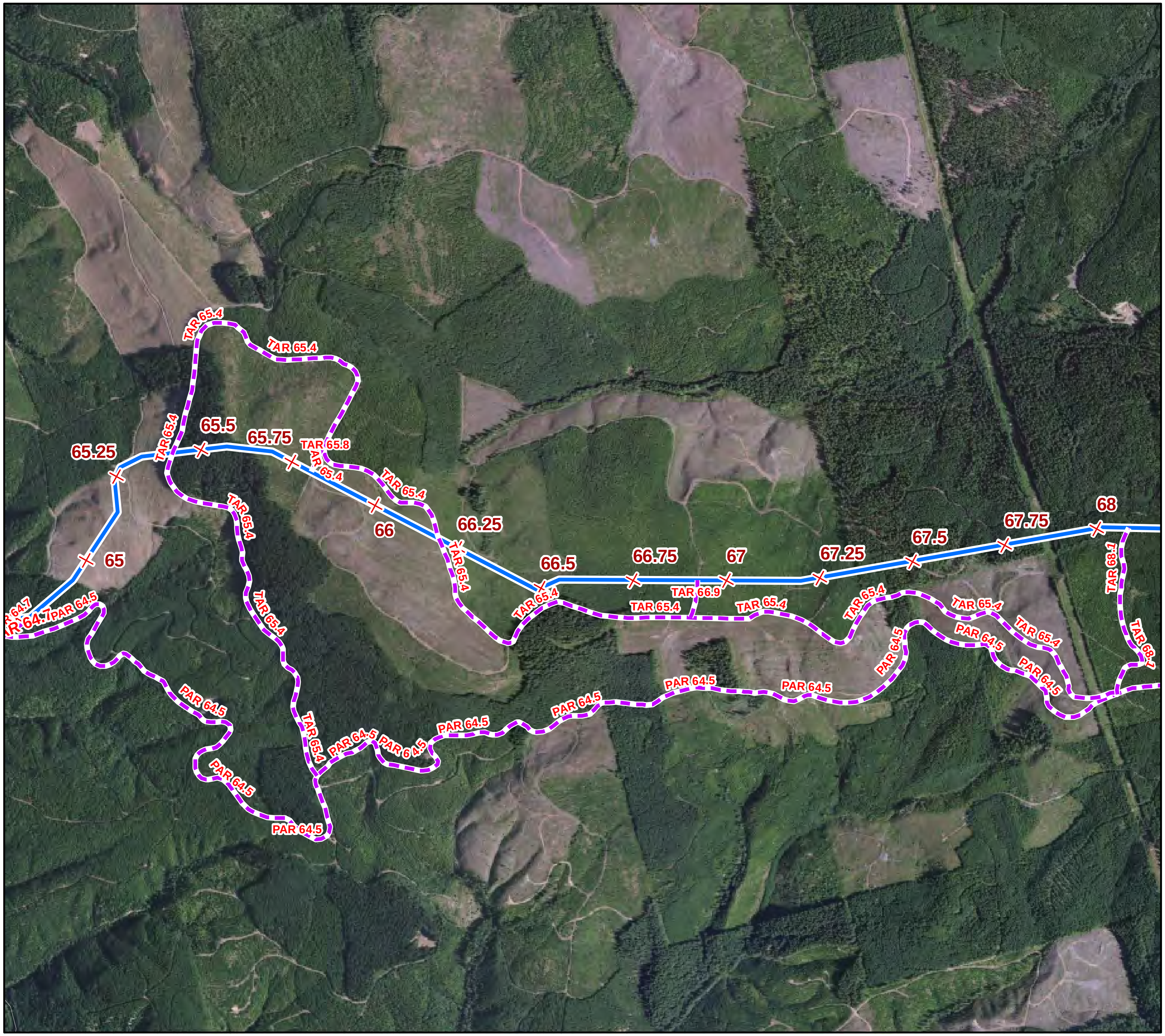
0 1,000 2,000
Feet

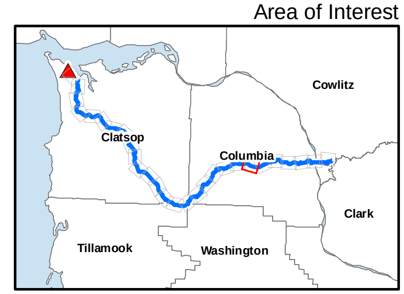
Figure 23
Access Roads for the Project



LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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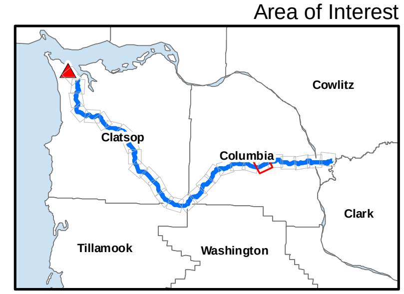
0 1,000 2,000
Feet

Figure 24
Access Roads for the Project

LEGEND
Pipeline Route Milepost (Qtr Mile)
Pipeline Route
New Access Road
Existing Access Road

Area of Interest



N

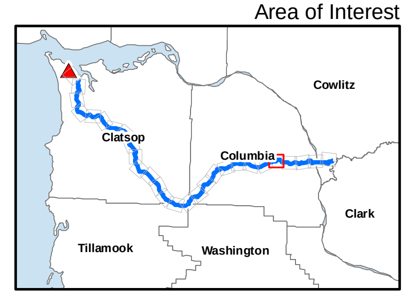
0 1,000 2,000
Feet

Figure 25
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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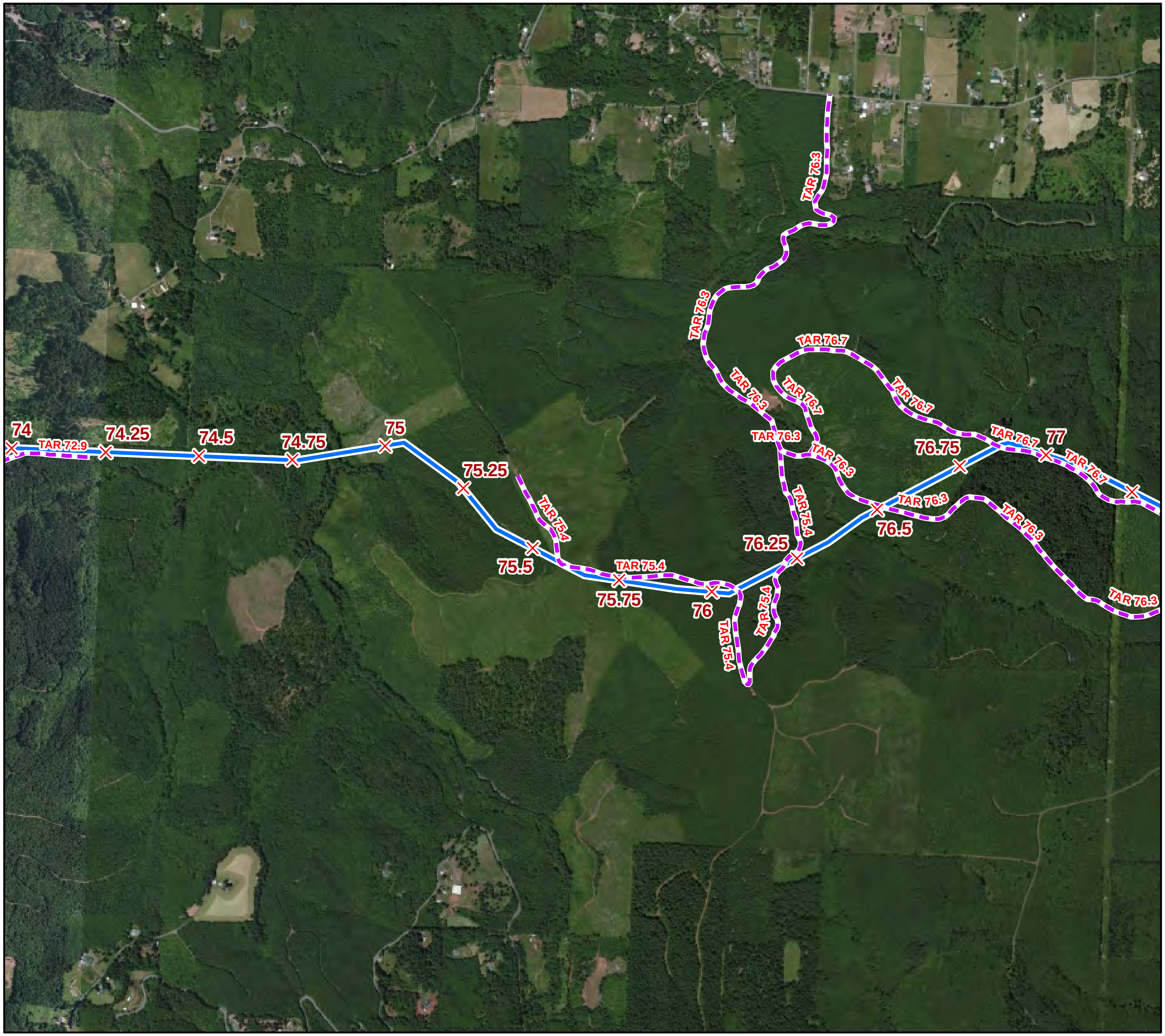
0 1,000 2,000
Feet

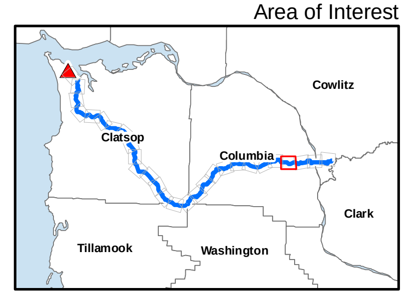
Figure 26
Access Roads for the Project



LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



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0 1,000 2,000
Feet

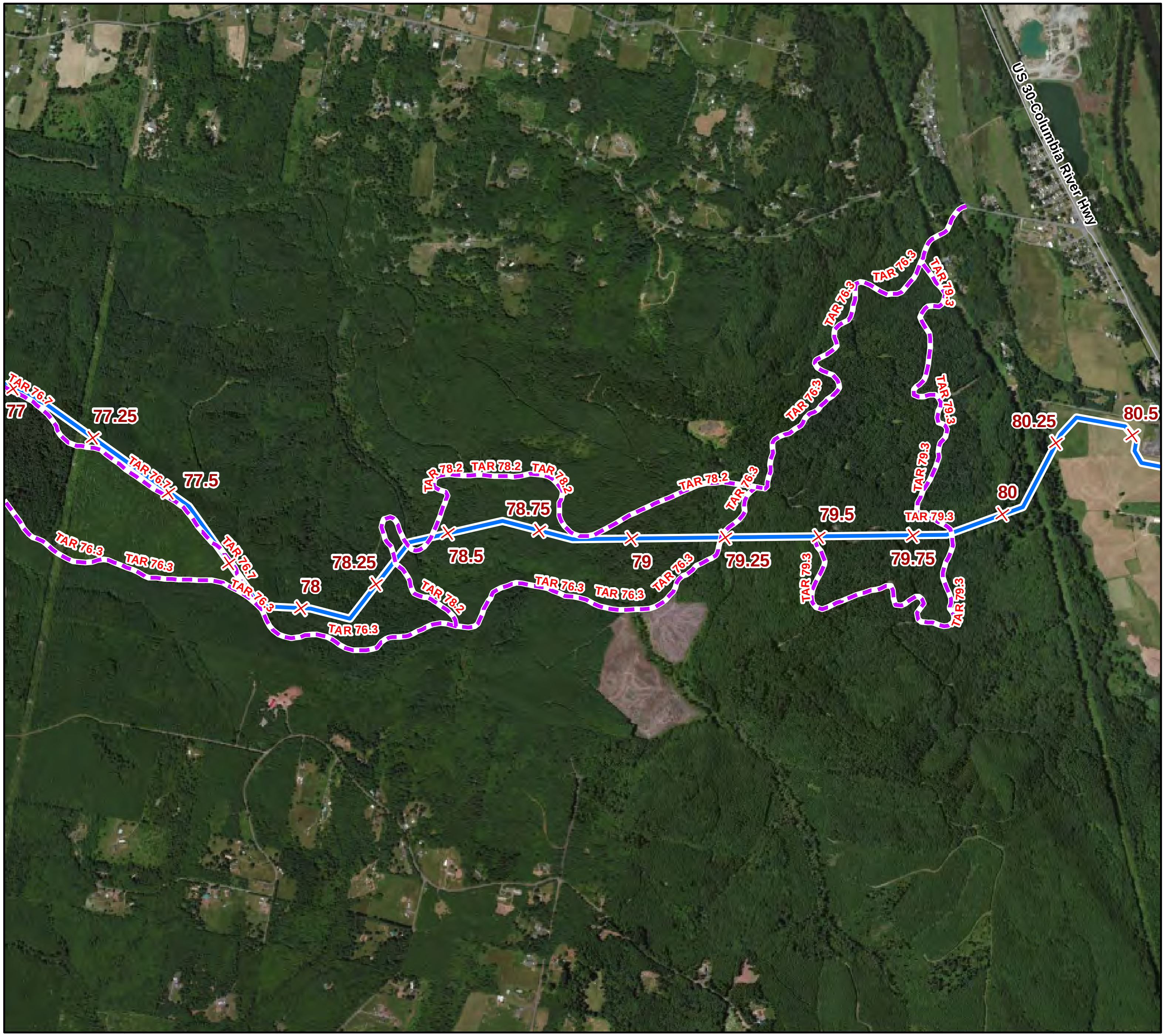


Figure 27
Access Roads for the Project

LEGEND
- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

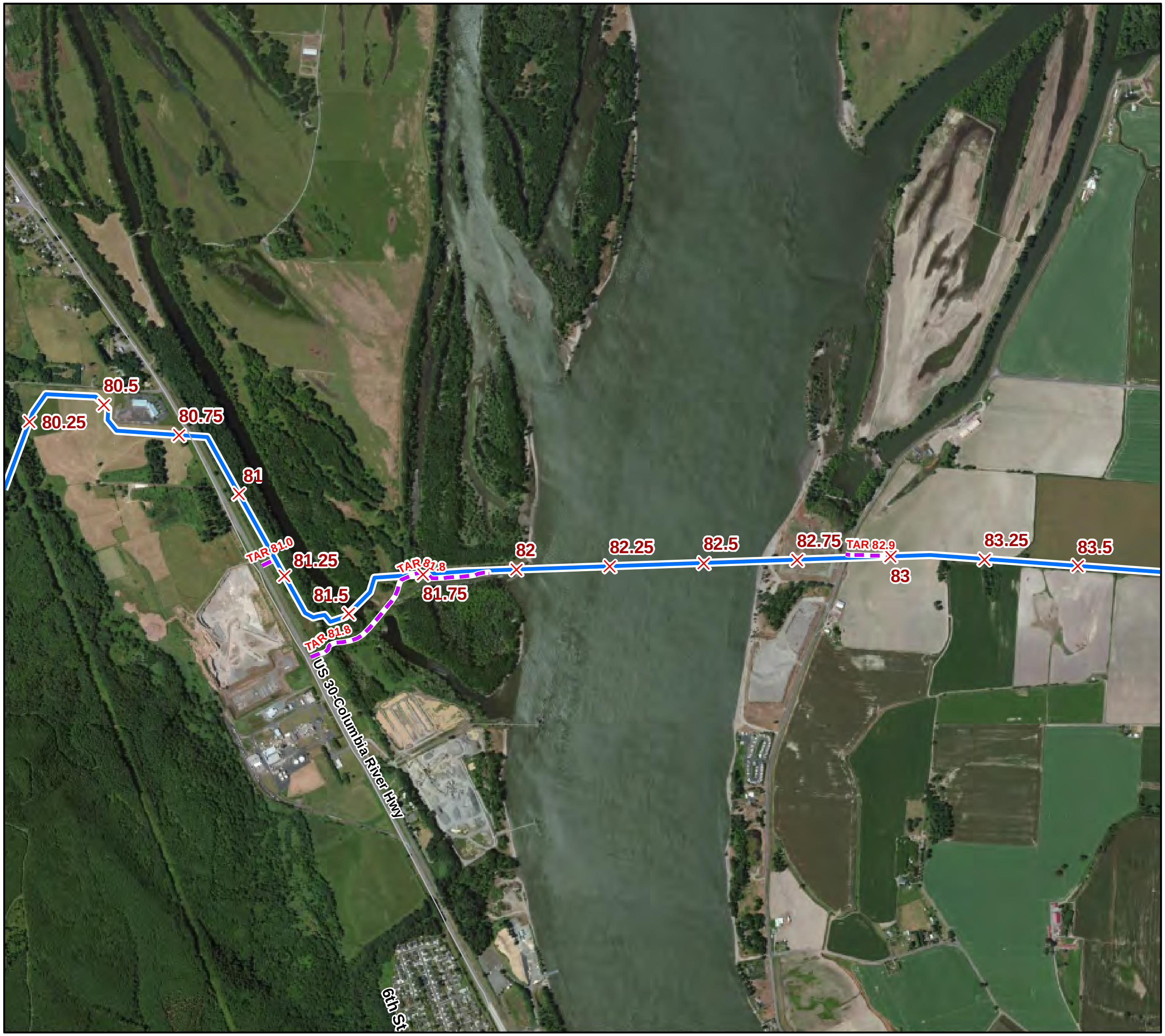
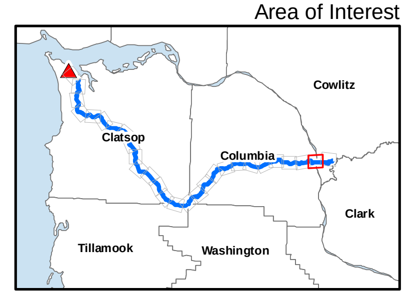


Figure 28
Access Roads for the Project

LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



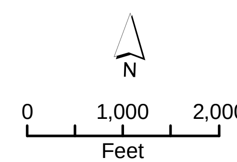
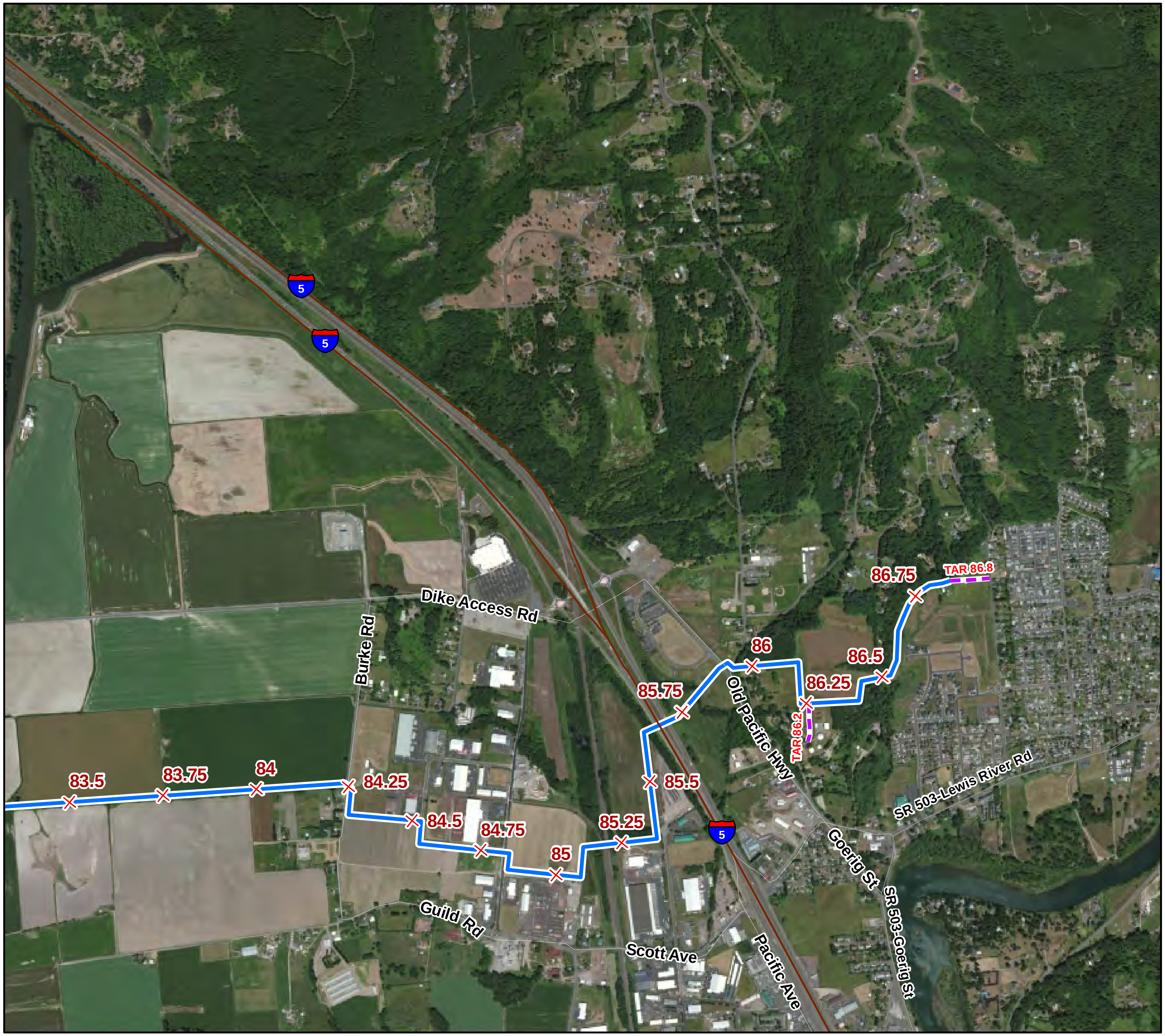


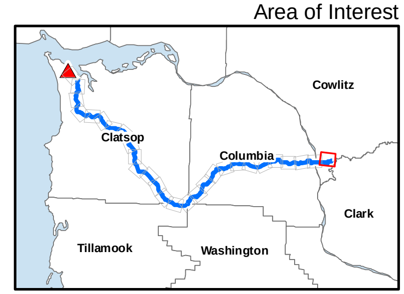
Figure 29
Access Roads for the Project



LEGEND

- Pipeline Route Milepost (Qtr Mile)
- Pipeline Route
- New Access Road
- Existing Access Road

Area of Interest



N

0 1,000 2,000
Feet

Appendix E5

Access Roads for Oregon LNG Pipeline

Access Road ID	Milepost	Existing/New	Temporary/ Permanent	Length (feet)	Width (feet)	Acres	Surface Type	Existing Land Use	Comment/Notes
TAR 3.8	3.9	Existing	Temporary	1,170	12.0	0.3	Dirt	Private Road	
PAR 4.8	4.8	Existing	Permanent	2,150	30.0	1.48	Gravel	Private Road	
TAR 6.5	6.9	Existing	Temporary	2,000	12.0	0.6	Gravel	Private Road	
TAR 7.0	7.6	Existing	Temporary	2,000	12.0	0.6	Gravel	Private Road	
TAR 7.5	8.1	Existing	Temporary	2,100	12.0	0.6	Unknown	Private Road	
TAR 8.0	8.5	Existing	Temporary	16,100	12.0	4.4	Gravel	Private Road	
TAR 9.8	10.2	Existing	Temporary	1,650	12.0	0.5	Gravel	Private Road	
TAR 10.3	10.6	Existing	Temporary	22,500	18.0	9.3	Gravel	Private Road	
TAR 11.0	11.9	Existing	Temporary	9,600	12.0	2.6	Gravel	Private Road	
TAR 11.5	12.0	Existing	Temporary	13,300	12.0	3.7	Gravel	Private Road	
TAR 12.8	13.0	Existing/New	Temporary	500	12.0	0.1	Gravel	Private Road/ Industrial Forest	400-foot extension required to connect existing road to pipeline right-of-way.
TAR 13.0	13.5	Existing	Temporary	12,750	12.0	3.5	Gravel	Private Road	
TAR 13.0A	*	Existing	Temporary	16,350	14.0	5.3	Gravel	Private Road	
TAR 13.5	14.0	Existing/New	Temporary	700	12.0	0.2	Gravel	Private Road/ Industrial Forest	200-foot extension required to connect existing road to pipeline right-of-way.
TAR 13.8	14.3	Existing	Temporary	14,600	12.0	4.0	Gravel	Private Road	
TAR 14.3	14.8	Existing	Temporary	800	12.0	0.2	Gravel	Private Road	
TAR 14.5	15.8	Existing/New	Temporary	9,050	12.0	2.5	Gravel	Private Road	Assumes widening of short section (approximately 1,200 feet) of road leading to Milepost 15
TAR 14.8	15.1	Existing	Temporary	1,150	12.0	0.3	Gravel	Private Road	
TAR 15.3	*	Existing	Temporary	46,510	18.0	19.2	Gravel	Private Road	
PAR 15.3	15.3	Existing	Permanent	69,670	18.0	28.8	Gravel	Private Road	
TAR 16.0	16.6	Existing	Temporary	4,350	12.0	1.2	Gravel	Private Road	
TAR 16.5	17.0	Existing	Temporary	8,550	12.0	2.4	Gravel	Private Road	
TAR 17.3	17.8	Existing	Temporary	2,350	12.0	0.6	Gravel	Private Road	
TAR 18.0	18.6	Existing	Temporary	300	12.0	0.1	Gravel	Private Road	
TAR 18.8	19.3	Existing	Temporary	100	12.0	<0.1	Gravel	Private Road	
TAR 19.5	20.1	Existing	Temporary	1,800	12.0	0.5	Gravel and Dirt	Private Road	
TAR 20.3	20.8	Existing	Temporary	4,650	12.0	1.3	Gravel	Private Road	
TAR 20.8	21.3	Existing	Temporary	7,950	12.0	2.2	Gravel	Private Road	
TAR 21.5	*	Existing	Temporary	11,720	12.0	3.2	Gravel	Private Road	

Access Roads for Oregon LNG Pipeline

Access Road ID	Milepost	Existing/New	Temporary/ Permanent	Length (feet)	Width (feet)	Acres	Surface Type	Existing Land Use	Comment/Notes
PAR 21.5	21.5	Existing	Permanent	25,600	12.0	7.1	Gravel	Private Road	
TAR 22.3	22.8	Existing	Temporary	11,900	12.0	3.3	Gravel	Private Road	
TAR 23.0	23.5	Existing	Temporary	7,400	12.0	2.0	Gravel	Private Road	
TAR 23.5	24.0	Existing	Temporary	800	12.0	0.2	Gravel	Private Road	
PAR 23.8	23.8	Existing	Permanent	10,800	12	3.0	Gravel	Private Road	
TAR 24.3	24.7	Existing	Temporary	500	12.0	0.1	Gravel	Private Road	
TAR 24.5	24.5	Existing	Temporary	4,700	12.0	1.3	Gravel	Private Road	
TAR 24.8	25.4	Existing	Temporary	9,150	12.0	2.5	Gravel	Private Road	
TAR 24.8A	*	Existing	Temporary	8,775	12.0	2.4	Gravel	Private Road	
TAR 25.5	26.1	Existing	Temporary	14,300	12.0	3.9	Gravel	Private Road	
TAR 26.0	26.5	Existing	Temporary	800	12.0	0.2	Dirt and Grass	Private Road	
TAR 26.3	26.7	Existing/New	Temporary	1,100	12.0	0.3	Dirt and Grass	Private Road/ Industrial Forest	300-foot extension required to connect existing road to pipeline right-of-way.
TAR 26.8	27.2	Existing/New	Temporary	1,600	12.0	0.4	Gravel	Private Road/ Industrial Forest	1,500-foot extension required to connect existing road to pipeline right-of-way.
TAR 27.0	27.6	Existing/New	Temporary	1,300	12.0	0.4	Gravel	Private Road/ Industrial Forest	300-foot extension required to connect existing road to pipeline right-of-way.
TAR 27.5	27.9	Existing	Temporary	1,550	12.0	0.4	Gravel	Private Road	
TAR 27.8	28.3	Existing	Temporary	31,650	16.0	11.6	Gravel	Private Road	
TAR 27.8A	*	Existing	Temporary	3,000	12.0	0.8	Gravel	Private Road	
TAR 28.0	28.7	Existing	Temporary	2,100	12.00	0.6	Gravel	Private Road	
TAR 28.3	28.8	Existing	Temporary	3,600	16.0	7.8	Gravel	Private Road	
TAR 28.8	29.2	Existing	Temporary	21,100	12.0	5.8	Gravel	Private Road	
TAR 28.8A	29.3	Existing	Temporary	600	12.0	0.2	Gravel	Private Road	
TAR 29.3	29.7	Existing	Temporary	4,900	12.0	1.3	Gravel	Private Road	
TAR 30.0	30.6	Existing	Temporary	9,300	12.0	2.6	Gravel	Private Road	
TAR 30.3	31.0	Existing	Temporary	3,200	12.0	0.9	Gravel	Private Road	
TAR 31.0	31.5	Existing	Temporary	4,900	12.0	1.3	Gravel	Private Road	
TAR 31.3	31.7	Existing	Temporary	9,600	12.0	2.6	Gravel	Private Road	
TAR 31.5	31.9	Existing	Temporary	1,600	12.0	0.4	Gravel	Private Road	
TAR 32.0	32.4	Existing	Temporary	700	12.0	0.2	Gravel	Private Road	
TAR 32.3	32.8	Existing	Temporary	14,100	14.0	4.5	Gravel	Private Road	

Appendix E5

Access Roads for Oregon LNG Pipeline

Access Road ID	Milepost	Existing/New	Temporary/ Permanent	Length (feet)	Width (feet)	Acres	Surface Type	Existing Land Use	Comment/Notes
TAR 32.5	33.1	Existing/New	Temporary	1,150	12.0	0.3	Gravel	Private Road/ Industrial Forest	250-foot extension required to connect existing road to pipeline right-of-way.
TAR 35.5	35.2	Existing	Temporary	10,250	12.0	2.8	Gravel	Private Road	
TAR 36.3	36.6	Existing	Temporary	150	12.0	<0.1	Gravel	Private Road	
TAR 36.8	37.2	Existing	Temporary	9,400	12.0	2.6	Gravel	Private Road	
TAR 38.8	39.1	Existing	Temporary	6,950	22.0	3.5	Gravel	Private Road	
TAR 39.3	40.0	Existing	Temporary	5,100	22.0	2.6	Gravel	Private Road	
TAR 40.8	*	Existing	Temporary	2,500	22.0	0.3	Gravel	Private Road	
TAR 41.8	42.3	Existing	Temporary	2,150	22.0	1.1	Gravel	Private Road	
TAR 42.8	43.1	Existing	Temporary	600	22.0	0.3	Gravel	Private Road	
TAR 43.5	44.1	Existing	Temporary	250	25.0	0.1	Gravel	Private Road	
TAR 45.0	45.6	Existing/New	Temporary	950	15.0	0.3	Gravel	Private Road/ Upland Forest	400-foot extension required to connect existing road to pipeline right-of-way.
TAR 46.3	46.7	Existing	Temporary	650	20.0	0.3	Gravel	Private Road	
TAR 48.3	48.3	Existing	Temporary	2,640	12.0	0.7	Gravel	Private Road	
TAR 48.6	48.7	Existing	Temporary	1,056	12.0	0.3	Gravel	Private Road	
TAR 49.2	49.2	Existing	Temporary	20,064	14.0	6.4	Gravel	Private Road	
TAR 50.2	50.2	Existing	Temporary	22,704	14.0	7.3	Gravel	Private Road	
TAR 50.5	50.5	Existing	Temporary	2,640	12.0	0.7	Dirt/Gravel	Private Road	
TAR 51.2	51.2	Existing	Temporary	600	12.0	0.2	Gravel	Private Road	
TAR 51.4	51.4	Existing	Temporary	11,088	12.0	3.1	Gravel	Private Road	
TAR 52.2	52.3	Existing	Temporary	2,640	12.0	0.7	Gravel	Private Road	
TAR 52.7	52.8	Existing/New	Temporary	4,224	12.0	1.2	Dirt/Gravel	Private Road	3,170-foot extension required to connect existing road to proposed pipeline right-of-way.
TAR 53.6	53.6	Existing	Temporary	27,984	16.0	10.3	Gravel	Private Road	
TAR 54.2	54.2	Existing	Temporary	4,224	12.0	1.2	Gravel	Private Road	
TAR 54.9	54.9	Existing	Temporary	7,392	12.0	2.0	Gravel	Private Road	Requires brushing for 6,200 feet
TAR 55.4	55.4	Existing	Temporary	3,168	12.0	0.9	Gravel	Private Road	
TAR 55.8	55.8	Existing	Temporary	9,504	12.0	2.6	Gravel	Private Road	
TAR 56.1	56.1	Existing	Temporary	7,920	12.0	2.2	Gravel	Private Road	
TAR 56.6	56.6	Existing	Temporary	13,200	14.0	4.2	Gravel	Private Road	
TAR 57.0*	N/A	Existing	Temporary	8,976	12.0	2.5	Gravel	Private Road	
TAR 57.6	57.6	Existing	Temporary	16,896	12.0	4.7	Gravel	Private Road	

Appendix E5

Access Roads for Oregon LNG Pipeline

Access Road ID	Milepost	Existing/New	Temporary/ Permanent	Length (feet)	Width (feet)	Acres	Surface Type	Existing Land Use	Comment/Notes
TAR 58.2	58.2	Existing	Temporary	2,112	12.0	0.6	Gravel	Private Road	
TAR 58.7	58.7	Existing	Temporary	8,976	12.0	2.5	Gravel	Private Road	
TAR 59.2	59.2	Existing/New	Temporary	24,816	14.0	8.0	Gravel	Private Road	500-foot extension required to connect existing road to proposed pipeline right-of-way.
TAR 60.5	60.5	Existing	Temporary	440	12.0	0.1	Gravel	Private Road	
TAR 62.7	62.7	Existing	Temporary	1,056	12.0	0.3	Gravel	Private Road	
TAR 63.4	63.5	Existing	Temporary	3,168	14.0	1.0	Gravel	Private Road	11-foot-wide, 40-ton bridge
TAR 64.1	64.1	Existing	Temporary	2,112	12.0	0.6	Dirt/Gravel	Private Road	
PAR 64.5*	N/A	Existing	Permanent	53,856	16.0	19.8	Gravel	Public Road	
TAR 64.7	64.8	Existing	Temporary	440	12.0	0.1	Gravel	Private Road	
TAR 65.4	65.4	Existing	Temporary	25,344	12.0	7.0	Gravel	Private Road	
TAR 65.8	65.8	Existing	Temporary	400	12.0	0.1	Gravel	Private Road	
TAR 66.9	66.9	Existing	Temporary	520	12.0	0.1	Gravel	Private Road	
TAR 68.1	68.1	Existing	Temporary	2,640	12.0	0.7	Gravel	Private Road	
PAR 69.1	69.1	Existing	Permanent	3,696	12.0	1.0	Gravel	Public Road	
TAR 69.6	69.6	Existing	Temporary	1,056	12.0	0.3	Gravel	Private Road	
TAR 70.3	70.4	Existing	Temporary	12,144	12.0	3.3	Gravel	Private Road	
TAR 71.1	71.1	Existing	Temporary	35,376	12.0	9.7	Gravel	Private Road	Remove road block at road entrance
TAR 72.0	72.0	Existing	Temporary	2,112	12.0	0.6	Gravel	Private Road	
TAR 72.9	72.9	Existing	Temporary	2,112	12.0	0.6	Gravel	Private Road	
TAR 75.4	75.4	Existing	Temporary	9,504	12.0	2.6	Gravel	Private Road	
TAR 76.3	76.3	Existing	Temporary	31,152	12.0	8.6	Gravel	Private Road	
TAR 76.7	76.7	Existing/New	Temporary	10,560	12.0	2.9	Gravel	Private Road	9.5-foot-wide road for 300 feet
TAR 78.2	78.2	Existing	Temporary	8,976	12.0	2.5	Gravel	Private Road	
TAR 79.3	79.3	Existing	Temporary	11,616	12.0	3.2	Gravel	Private Road	
TAR 81.0	81.0	Existing/New	Temporary	114	12.0	0.03	Gravel	Private Road	90-foot extension required to connect existing road to proposed pipeline right-of-way.
TAR 81.8	81.8	Existing	Temporary	4,752	12.0	1.3	Gravel	Private Road	
TAR 82.9	82.9	Existing	Temporary	650	12.0	0.2	Dirt/Grass	Private Road	Improve Farm Road
TAR 86.2	86.2	Existing	Temporary	548	12.0	0.2	Gravel/Dirt	Private Road	
TAR 86.8	86.8	Existing	Temporary	550	12.0	0.2	Gravel	Private Road	

* = Road does not intersect pipeline right-of-way.
N/A = not applicable
Precision loss may occur because of rounding.

APPENDIX E6

SITE-SPECIFIC RESIDENTIAL CONSTRUCTION PLANS

Mitigation Steps:

1) Meet with land owner(s) of impacted residence at the project site at least 21 days prior to beginning of construction.
   a) Review construction procedures, locations of permanent and temporary easements, and ATWS.
   b) Identify trees, other vegetation, and objects that land owner(s) desire to have protected during construction. To the extent practical, protect these items during construction, or move and replace after construction if possible.
2) At least 7 days prior to construction, survey locations of easements and ATWS and mark locations using wooden laths or other markers.
3) Conduct a preconstruction survey of the impacted residence. Preconstruction survey shall include photographs and video of vegetation, fences, driveways, stone walls, structures, residences, sidewalks, and water systems preconstruction conditions.
4) Erect orange barrier fencing and erosion control features that include, at a minimum, silt fence inside the boundaries of the ATWS and temporary easement nearest the pole barns and house.
5) Conduct construction activities between Stations B586+00 and B596+00 only between the hours of 8 a.m. and 5 p.m.
6) Upon completion of pipeline installation, reseed disturbed ground, repair access roads, graveled or paved areas, sidewalks, fences, stone walls, structures, water supply systems, and septic systems, and conduct other mitigation to reestablish preconstruction conditions.

LEGEND

- TWS (TEMPORARY WORK SPACE)
- ATWS (ADDITIONAL TEMPORARY WORK SPACE)
- PERMANENT EASEMENT LINE
- ALIGNMENT PI (POINT OF INTERSECTION)
- PROPERTY LINE
- OVERHEAD POWER LINE
- PROPOSED ALIGNMENT MILEPOST

ES030613113935PDX 199863.RR.14

NO.	DATE	REVISION	BY	APVD

DSGN	DR	CHK	APVD
T POTTER	J PFEIFER	M BRICKER	XXX

SCALE 1"=100'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

OregonLNG

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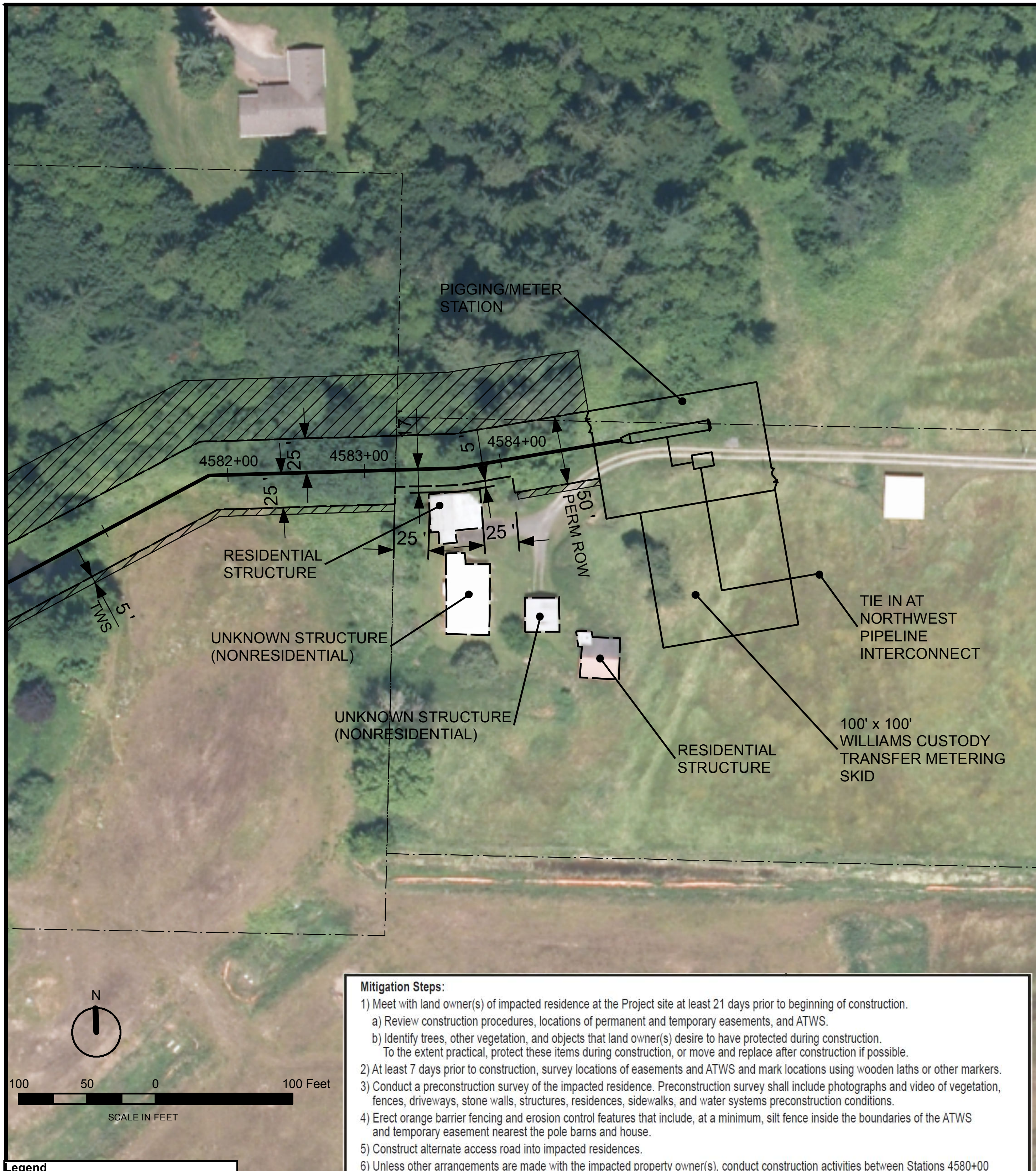
OREGON PIPELINE COMPANY
PIPELINE
WARRENTON TO WOODLAND

RESIDENTIAL MITIGATION PLAN
MP 11.2

PROJ: 355036	DATE: JUNE 26, 2009	DWG: C-529	REVISION: 1

FILENAME: C-529_new.dgn PLOT DATE: 5/9/2013 PLOT TIME: 8:10:01 AM



Mitigation Steps:

1) Meet with land owner(s) of impacted residence at the Project site at least 21 days prior to beginning of construction.
   a) Review construction procedures, locations of permanent and temporary easements, and ATWS.
   b) Identify trees, other vegetation, and objects that land owner(s) desire to have protected during construction. To the extent practical, protect these items during construction, or move and replace after construction if possible.
2) At least 7 days prior to construction, survey locations of easements and ATWS and mark locations using wooden laths or other markers.
3) Conduct a preconstruction survey of the impacted residence. Preconstruction survey shall include photographs and video of vegetation, fences, driveways, stone walls, structures, residences, sidewalks, and water systems preconstruction conditions.
4) Erect orange barrier fencing and erosion control features that include, at a minimum, silt fence inside the boundaries of the ATWS and temporary easement nearest the pole barns and house.
5) Construct alternate access road into impacted residences.
6) Unless other arrangements are made with the impacted property owner(s), conduct construction activities between Stations 4580+00 and Northwest Pipeline Interconnect, including all construction activities associated with the pigging/meter station and Williams Custody Transfer Metering skid between the hours of 8 a.m. and 5 p.m.
7) Upon completion of pipeline installation, reseed disturbed ground, repair access roads, graveled or paved areas, sidewalks, fences, stone walls, structures, water supply systems, and septic systems, and conduct other mitigation to reestablish preconstruction conditions.

Legend

- ATWS (ADDITIONAL TEMPORARY WORKSPACE)
- TWS (TEMPORARY WORKSPACE)
- PERMANENT EASEMENT LINE
- ALIGNMENT PI
- PROPERTY LINE

NO.	DATE	REVISION	BY	APVD.
DSGN. PS	DR MC	CHK	APVD. EC	

SCALE
1" = 100'

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY

OregonLNG

OREGON PIPELINE COMPANY
PIPELINE
WARRENTON TO WOODLAND

CH2MHILL

RESIDENTIAL MITIGATION PLAN
MP 86.6

PROJ. 199863 | DATE: MARCH 27, 2014 | DWG: C-533 | REVISION: 1

Document Path: M:\199863_Oregon_LNG\MapFiles\MXD\Residentials\Residential_Mitigation.mxd

APPENDIX F

OREGON LNG MITIGATION AND MONITORING PLANS

Appendix F1:	Stormwater Pollution Prevention Plan for Construction of the Oregon LNG Terminal and Pipeline, Including Erosion Prevention and Sediment Control Plan; Spill Prevention, Control, and Countermeasures Plan; and Frac-Out Contingency Plan
Appendix F2:	Agricultural Impact Mitigation Plan
Appendix F3:	Conceptual Mitigation Plan for the Oregon LNG Terminal and Oregon Pipeline Project
Appendix F4:	Wetland Mitigation Plan
Appendix F5:	Technical Memorandum: Oregon LNG Pipeline Waterbody Crossing: Fish Salvage Plan
Appendix F6:	Technical Memorandum: Migratory Birds—Regulatory Review and Mitigation

APPENDIX F1

STORMWATER POLLUTION PREVENTION PLAN FOR CONSTRUCTION OF THE OREGON LNG TERMINAL AND PIPELINE, INCLUDING EROSION PREVENTION AND SEDIMENT CONTROL PLAN; SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN; AND FRAC-OUT CONTINGENCY PLAN

Report

Stormwater Pollution Prevention Plan for Construction of the Oregon LNG Terminal and Pipeline, Including Erosion Prevention and Sediment Control Plan; Spill Prevention, Control, and Countermeasures Plan; and Frac-Out Contingency Plan

Prepared for

LNG Development Company, LLC (d/b/a Oregon LNG)
and
Oregon Pipeline Company, LLC

May 2013

Prepared by

CH2MHILL®

Contents

Attachments

Tables

Acronyms and Abbreviations

BPA	Bonneville Power Administration
BMP	best management practice
CFR	Code of Federal Regulations
EI	Environmental Inspector
EPA	United States Environmental Protection Agency
EPSCP	Erosion Prevention and Sediment Control Plan
ERC	Emergency Response Contractor
FERC	Federal Energy Regulatory Commission
FERC Plan	FERC Upland Erosion Control, Revegetation, and Maintenance Plan
FERC Procedures	FERC Wetland and Waterbody Construction Mitigation Procedures
HDD	horizontal directional drilling
hp	horsepower
LCC	Land Capability Class
LNG	liquefied natural gas
MP	milepost
MSDS	material safety data sheet
MW	megawatt
NPDES	National Pollutant Discharge Elimination System
OD	outside diameter
ODFW	Oregon Department of Fish and Wildlife
ODEQ	Oregon Department of Environmental Quality
RQ	reportable quantity
SPCC	Spill Prevention, Containment, and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan
Terminal	liquefied natural gas bidirectional terminal
TESC	temporary and permanent erosion and sediment control
TSS	total suspended solids
WEG	Wind Erodibility Group

SECTION 1.0

Stormwater Pollution Prevention Plan and Erosion Prevention and Sediment Control Plan

In June 2006, the United States Environmental Protection Agency (EPA) published a final rule for 40 *Code of Federal Regulations* (CFR) Part 122 to include Amendments to the National Pollutant Discharge Elimination System (NPDES) Regulations for Storm Water Discharge Associated with Oil and Gas Exploration, Production, Processing, or Treatment Operations or Transmission Facilities. This rule modified the NPDES regulations to exempt certain stormwater discharges from field activities or operations, including construction associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities. These discharges are exempt from permitting requirements except in situations when the construction-related activities result in the discharge of a hazardous substance or oil in "reportable" quantities or in situations when the discharge of a pollutant other than sediment contributes to a violation of an applicable water quality standard.

The rule also encouraged the application of best management practices (BMPs) for oil and gas field activities and operations to (a) minimize the discharge of pollutants in stormwater runoff and (b) protect water quality both during and after construction activities.

Installation of effective BMPs will help protect surface water during storm events, as well as help ensure that there is no discharge of a reportable quantity (RQ) or violation of the water quality standard.

This Stormwater Pollution Prevention Plan (SWPPP) has been developed to meet the spirit of the law. This plan has three elements, all intended to provide methods and procedures so the construction activities do not adversely affect the water quality of the receiving water bodies during construction. The three elements of this plan that are discussed in the following sections are as follows:

- Erosion Prevention and Sediment Control Plan (EPSCP)
- Spill Prevention, Containment, and Countermeasures Plan (SPCC Plan)
- Horizontal Directional Drilling Frac-out Contingency Plan

The purpose of this document is to describe the proposed construction activities and all temporary and permanent erosion and sediment control (TESC) measures, pollution prevention measures, inspection/monitoring activities, spill prevention measures and countermeasures, frac-out procedures, and record keeping that will be implemented during the construction Project. Included in this SWPPP are the following:

- Covered activities
- Best management practices to prevent erosion and sedimentation (in the EPSCP), and to identify, reduce, eliminate, or prevent stormwater contamination and water pollution from construction activity and to receiving water bodies
- Maintenance and inspection procedures
- Plan modification
- Required reports, documents, and record keeping
- Spill Prevention, Containment, and Countermeasures Plan
- Horizontal Directional Drilling Frac-out Contingency Plan
- Certifications

All personnel engaging in construction activities will follow this SWPPP.

SECTION 2.0

Description of Covered Activities

2.1 Scope of Activities

LNG Development Company, LLC (d/b/a Oregon LNG) proposes to own, construct, and operate a liquefied natural gas (LNG) bidirectional terminal (Terminal) consisting of marine facilities, LNG storage tanks, LNG vaporization facilities, natural gas liquefaction facilities, and associated support facilities, to be located in Warrenton, Oregon. The Terminal will have a base load liquefaction capacity of 9.6 million metric ton per year, which requires approximately 1.25 billion standard cubic feet per day of pretreated natural gas; and a base load regasification capacity of 0.5 billion standard cubic feet per day.

Natural gas will be transported to and from the Terminal via an approximately 86.8-mile-long, 36-inch-outside-diameter (OD) bidirectional pipeline (Pipeline) that is being developed by Oregon Pipeline Company, LLC (Oregon Pipeline; and together with LNG Development Company, LLC, Oregon LNG).[1] The Pipeline will interconnect with the interstate transmission system of Northwest Pipeline GP (Northwest), a subsidiary of the Williams Companies, at the Northwest Pipeline Interconnect near Woodland, Washington.[2] The Pipeline will be routed through Clatsop, Tillamook, and Columbia counties in Oregon, and Cowlitz County in Washington. An electrically driven gas compressor station (Compressor Station) will be constructed at milepost (MP) 80.8 of the Pipeline. The Terminal, Pipeline, and Compressor Station are collectively referred to as the Bidirectional Project or Project.

A complete description of the Project can be found in Resource Report 1—General Project Description.

2.2 Runoff Coefficient of Soils

During construction of the Project, existing vegetation will be removed and the risk that erosion may affect soils will increase. Soil erosion is strongly influenced by soil texture, soil structure, percent organic matter, vegetation or mulch cover, length and percent surface slope, and rainfall or wind intensity. Soils most susceptible to erosion are those with low cohesion (silts and very fine sand with little organic matter), low permeability, high surface slope and/or long slope lengths, and soils exposed to water and wind with little vegetation or surface mulch protection. The primary negative impact of soil erosion is the resulting loss of fertile topsoil and reduced site productivity.

The risk of soil erosion by water was based upon the Land Capability Class (LCC) and Subclass for each soil. Soils with an LCC of 3 or higher and a Subclass denoted with an “e” (i.e., soils with severe limitations because of erosion) were determined to have a high potential for water erosion. Also, any area designated in the soil surveys as water was considered to have high erosion potential. This includes areas covered by water (oceans, rivers, and lakes), as well as seasonally wet areas (wetlands, depressions, etc.). Seasonally wet areas often have reduced vegetation cover and are subject to drainage that increases the risk of erosion.

The risk of soil erosion by wind was based upon Wind Erodibility Groups (WEGs), which are a set of classes given to soils based on properties of the surface horizon such as texture, organic matter content, and aggregate stability that are considered particularly susceptible to wind erosion. WEGs of 1 or 2 out of 8 total groups denote the most severe erosion potential from wind. These values were derived from the SSURGO database.

The LCCs and Subclasses, WEGs, and identification of highly erodible soils are provided in Appendices 7C and 7D of Resource Report 7—Soils for the Pipeline route.

[1] The Terminal and Pipeline are proposed at the site, and along the route, of Oregon LNG’s proposed LNG import terminal and proposed pipeline that currently are pending before the Federal Energy Regulatory Commission in Docket Numbers CP09-6-000 and CP09-7-000, as amended in Docket Number PF12-18-000.

[2] A separate application will be filed by Northwest for the Washington Expansion Project, a capacity expansion to Northwest’s existing natural gas transmission facilities along the Interstate 5 corridor in the state of Washington.

The proposed construction work areas will be protected against erosion and restored in accordance with the Federal Energy Regulatory Commission (FERC) *Wetland and Waterbody Construction Mitigation Procedures* (FERC Procedures) and the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (FERC Plan). Temporary erosion controls specified in the FERC Plan include temporary slope breakers, sediment barriers, and mulching. To further minimize wind erosion, dust control measures will be used under conditions of high wind erosion potential, including routine wetting of the construction workspace where soils are exposed. Permanent erosion control measures will include (as specified in the FERC Plan) trench breakers, permanent slope breakers, and revegetation. Disturbed areas will be seeded using appropriate seeding dates as well as hardy, well-adapted species.

2.3 Discharge and Receiving Waters

2.3.1 Waterbody Crossings

The Pipeline, a 36-inch-OD pipe, will be constructed from the Terminal (MP 0.0) to an interconnect with the Northwest Pipeline system near Woodland, Washington (MP 86.8). The Pipeline will be configured for a potential interconnection with the 24-inch Northwest Natural Gas Company and South Mist Pipeline Extension at approximately MP 63.5 in Columbia County, Oregon.

A block valve, bidirectional metering, and pig launching facility will be located immediately adjacent to the Woodland interconnect location. The pressure of the gas will be boosted at the Compressor Station located approximately 6 miles from the interconnect near the west bank of the Columbia River in Oregon. A pig receiving and launching station will be located at the Compressor Station. A bidirectional metering and pig receiving/ launching facility will be located at the Terminal. The 48,000-horsepower (hp) Compressor Station will need approximately 40 megawatts (MW) of electric power to compress the natural gas at peak flow. The proposed source of the power is the 115-kilovolt (kV) Bonneville Power Administration (BPA) power line that runs north to south approximately ½ mile west of the Compressor Station.

No waterbodies will be crossed at the Terminal site, excluding intertidal areas of the Lower Columbia River Estuary. The Oregon LNG Pipeline will cross all waterbodies in accordance with the Procedures (Appendix 2B of Resource Report 2—Water Use and Quality). In general, Oregon LNG will construct waterbody crossings so that they are as perpendicular to the axis of the waterbody channel as engineering and routing conditions allow, reduce the amount of clearing on stream banks to that which is necessary, maintain ambient downstream flow rates, and limit the amount of equipment and activities in water bodies to that which is necessary to construct the crossing.

Intermittent and ephemeral streams that are dry at the time of crossing will be crossed using conventional upland construction techniques. The installation of the Pipeline and bedding material will be designed to withstand future flooding of these ephemeral streams. Other water bodies will be crossed using the most practical techniques identified based on the condition of the waterbody at the time of construction and in compliance with the regulatory permits and approvals and the FERC Procedures. Construction activities will be scheduled so that the Pipeline trench is excavated immediately prior to pipe-laying activities. In accordance with the FERC Procedures, the duration of construction will be limited to 24 hours across minor waterbodies (10 feet wide or less) and 48 hours across intermediate water bodies (between 10 and 100 feet wide). Excavated spoils will be stockpiled at least 50 feet from the edge of the waterbody, and appropriate erosion control devices will be installed (as discussed in Section 3.5). Site-specific HDD and waterbody crossing plans based on available information (for waterbodies greater than 100 feet wide) are included in Resource Report 1—General Project Description.

Depending on site conditions at the time of construction and within allowable conditions of all required state and federal permits, Oregon LNG may modify its crossing techniques. These crossing methods—and all other specialized construction methods to be used in wetland and stream crossings—are described in the Procedures (Appendix 2B of Resource Report 2).

Many of the streams in the Project area that will be crossed by the Pipeline are cold-water fisheries and require dry-crossing methods, unless approved otherwise by the Oregon Department of Fish and Wildlife (ODFW). In-water construction will be limited to ODFW-recommended work timing windows, unless otherwise authorized by ODFW (see construction schedule in Resource Report 1). Surface-water crossing methods for each stream were determined based on field surveys, review of fisheries data, and review of stream data. The general crossing methods are outlined below, and the selected crossing method for each stream is shown in Appendix 2Q of Resource Report 2. Those waterbodies where HDD will be used are shown in Table 1.

2.3.1.1 Crossing Method 1 (Dry Crossing—0 to 30 Feet)

This method is applicable to perennial (with flow) or intermittent and ephemeral streams between 0 and 30 feet in width that are cold-water fisheries and to perennial streams that may not be fish-bearing but are tributary to fish-bearing streams. Streamflow may be channeled into one or multiple flume pipes to convey water across the trench and maintain downstream flow. The trench will be excavated from under the flume pipe, the Pipeline will be threaded under the flume, the trench will be backfilled, and the flume pipe will be removed to restore natural downstream flow. If no fish are present in the stream, the crossing method may be modified with a dam and pump arrangement to convey stream water around the construction area. If the stream is dry at the time of construction, then method 3, below, will be the crossing method.

2.3.1.2 Crossing Method 2 (Horizontal Directional Drilling—HDD)

The HDD method is applicable to those waterbodies designated to be directionally drilled and shown in Table 1. Oregon LNG has developed an HDD Frac-Out Contingency Plan, included in Chapter 8 of this document, along with HDD site-specific drawings, provided separately in this filing. The location and depth of the Pipeline for this crossing method will be deep enough so that the Pipeline is not affected by the natural fill and scour process of the rivers during peak flow events.

TABLE 1
Horizontal Directional Drilling Locations

Drilling Location	Milepost		Length (feet)
	Begin	End	
Pipeline			
Highway 101 and Adair Slough @ MP 1	0.9	1.1	1,210
Lewis and Clark River @ MP 3	2.8	3.4	2,950
Lewis and Clark River @ MP 5.0	5.0	5.5	2,450
Lewis and Clark River @ MP 5.5	5.6	6.0	2,100
Lewis and Clark River @ MP 11	10.9	11.2	1,320
Nehalem River @ MP 33.5	33.3	33.7	2,010
Highway 26 @ MP 41	40.9	41.3	1,910
Highway 26 @ MP 43.5	43.1	43.6	2,920
Rock Creek @ MP 57.5	57.5	58.1	3,000
Nehalem River @ MP 64	63.6	64.3	3,370
Columbia River @ MP 82.5	81.8	83.0	6,100
Water Supply Pipeline			
Skipanon River	NA	NA	2,200

2.3.1.3 Crossing Method 3 (Wet Crossing)

This method is applicable to intermittent and ephemeral streams that are not fish-bearing, as well as to fish-bearing intermittent or ephemeral streams if dry at the time of construction. Perennial streams that are minor, non-fish-bearing, and not directly tributary to a fish-bearing stream may also use this crossing method. This method is the open-cut method allowable for the crossing of minor or intermediate water bodies. The restrictions on instream work time (24 to 48 hours), restoration of preconstruction contours, limitations on equipment operating in the waterbody, or required bridging identified in the Procedures (Appendix 2B of Resource Report 2) will be followed.

The FERC Procedures specify the following practices for open-cut crossings:

- Limit the use of the equipment operating in the waterbody to only the needed equipment.
- Complete trenching and backfilling within 24 continuous hours for minor water bodies and 48 hours for intermediate water bodies.
- Return the waterbody to its preconstruction contours.
- Stabilize channel banks and install temporary sediment barriers within 24 hours after completing the crossing.
- Revegetate disturbed riparian areas.

To implement the above practices, the Pipeline will cross streams and wetlands. Appendix 2Q of Resource Report 2 describes each stream crossing, including the length of the crossing and the method used for installing the Pipeline.

2.3.2 Wetland Crossings

Efforts will be made before, during, and after Terminal and Pipeline construction to minimize the extent and duration of Project-related disturbance to wetland resources. A detailed discussion of construction and mitigation measures within wetlands and waterbodies is provided in the FERC Procedures, and in the Wetland Mitigation Plan prepared for this Project (Appendix 2P of Resource Report 2). Four general construction procedures are typically used to minimize impacts associated with construction of the Terminal and Pipeline on water resources, as described below.

2.3.2.1 Crossing Method 1

This method will be used in dry wetlands where soils are stable enough to support equipment without sinking (e.g., mineral hydric soils), or in wetlands that have already been disturbed to provide sufficient traffic access. A reduced construction easement of 75 feet will be adhered to and upland construction techniques will be used, unless alternative measures are required by site conditions, are approved by FERC, and would achieve a comparable level of mitigation. Topsoil will be segregated, and no matting will be used if conditions are dry. Excessive rutting will be avoided.

2.3.2.2 Crossing Method 2

This method will be used in wetlands where the soils are too wet (e.g., permanently or semi-permanently saturated and/or histic epipedon) to support mainline construction equipment. Timber mats will be used as necessary to support the construction equipment. A reduced construction easement of 75 feet will be adhered to and upland construction techniques will be used, unless alternative measures are approved. Topsoil will not be segregated.

2.3.2.3 Crossing Method 3

This method will be used in wetlands with standing water (permanently or semi-permanently flooded) where it is necessary to use push/pull construction techniques. A construction corridor wide enough for only a single tractor to work on timber mats will be used. The trench will be dug and the pipe will be pulled into place. There will be no passing or working lanes, only room for spoil on each side of the trench with the digging/pulling tractor in the middle. A reduced construction easement of 75 feet will be maintained and upland construction techniques will be used, unless alternative measures are approved.

2.3.2.4 Crossing Method 4

Horizontal directional drilling methods will be used for specialized crossings of large wetland areas. In general, because an open-cut trench is not required, directional drilling results in fewer adverse impacts and less turbidity than conventional excavation methods. Directional drilling is limited in application and dependent on critical wetland characteristics, including subsurface lithology, crossing length, burial depth, sediment composition, bank conditions, and access. Adverse environmental impacts that may result from drilling operations on waterway crossings would be related to discharge and transportation of drilling fluid; however, aside from turbidity effects, drilling fluid is a relatively environmentally benign substance. Mitigation of any adverse impact from drilling fluid would be by collection and cleanup of spilled material.

Oregon LNG intends to restore and, where necessary, compensate for disturbance to wetlands associated with construction and operation of the Project, as described in the Procedures (Appendix 2B to Resource Report 2). Along the Pipeline easement, forested wetlands that will become part of the permanent easement will be rehabilitated to and maintained in an herbaceous, scrub-shrub, and small tree state. Forested wetlands and scrub-shrub wetlands cleared for temporary workspace (i.e., construction easement) will be disturbed only temporarily and allowed to revert to their preconstruction condition. Scrub-shrub wetlands, herbaceous wetlands, and in some locations, forested wetlands will be allowed to revert to their preconstruction condition on the permanent easement. In both former scrub-shrub and forested wetlands, however, a corridor centered on the Pipeline and up to 10 feet wide will be maintained with herbaceous wetland species. Trees that establish within 15 feet of the Pipeline and grow greater than 15 feet in height may be cut and removed from the permanent easement following revegetation.

2.3.3 Backfill Material Source and Volumes

The source of backfill material will be the material removed from the trench for emplacement of the pipe. This same material, less the volume occupied by the 36-inch pipe or 24-inch pipe, will be returned to the trench.

2.4 Potential Sources of Contamination from Construction

The potential sources of pollutants that could be discharged in the receiving water bodies through contact with stormwater during construction activities include the following:

- Vehicle and equipment fueling and maintenance areas
- Materials handling/loading and unloading areas
- Erosion (wind, water, ice)
- Tracking from equipment
- Grading and site preparation
- Drilling
- Trenching
- Hazardous material storage areas
- Storage yards
- Mobile equipment
- Painting

2.4.1 Vehicle and Equipment Fueling and Maintenance

Fueling and minor maintenance of vehicles and equipment are conducted on some construction sites. These activities can be potential sources of leaks and incidental spills of fuel (during fueling), oil, and grease.

2.4.2 Materials Handling/Loading and Unloading Areas

Materials handling/loading and unloading activities are common on construction sites. Materials may be spilled, leaked, or lost during loading and unloading, and may collect in the soil or other surfaces and be carried away in stormwater. Machines used to unload materials also may be a source of stormwater pollution.

2.4.3 Erosion

Erosion is caused where soil is exposed to water, wind, or ice. Erosion can be caused by removing vegetation, compacting or disturbing the soil, changing natural drainage patterns, and covering the ground with impermeable surfaces (buildings, pavement, or concrete), all of which are integral parts of construction projects. Erosion is a source of sediment in stormwater.

2.4.4 Tracking

Construction equipment and construction vehicles have the potential to track soils from the construction Project into public roadways. Any soils tracked may be a possible source of sediment in stormwater.

2.4.5 Drilling

Horizontal drilling will be used at various locations throughout the Project. Mud rotary techniques will be used to transport the cuttings to bins. The rotary mud could become a potential source of sediment-laden water if not managed appropriately.

2.4.6 Trenching

During the installation of Pipeline sections, open trenching will be used in various locations throughout the Project. During this type of installation, the stockpiled material will be exposed, and it could be a source of sediment if not managed appropriately.

2.4.7 Grading and Site Preparation

Grading and site preparation may be required at some locations and can be major contributors of suspended solids concentrations in stormwater. The increased possibility of erosion exists throughout the grading and site preparation phases of construction projects until construction is complete.

2.4.8 Hazardous Material Storage Areas

Hazardous material storage areas have the potential to release hazardous substances that may pose a threat to human health or the environment. Hazardous materials may be toxic, corrosive, ignitable, explosive, or chemically reactive. There is a potential for hazardous materials to be stored on construction sites. Outdoor storage areas include drums, sheds, clamshells, and yellow flammable cabinets.

2.4.9 Storage Yards

Storage yards may contain equipment, construction materials, and construction debris that, when exposed to runoff, may pollute stormwater. A wide range of contaminants (metals, oil, and grease) may enter the environment by washing off or dissolving from stored material.

2.4.10 Mobile Equipment

Portable tanks and other mobile equipment are used extensively on construction sites. This equipment may generate fuel or oil leaks or spills. Portable tanks and bins will be used to store wastes generated during this Project.

2.4.11 Painting

During painting and paint removal activities, materials may be used (and wastes created) that are harmful to humans and the environment. Pollutants may include solvents, solids, and metals.

SECTION 3.0

Best Management Practices

Erosion Prevention and Sediment Control Plan BMPs are controls (both structural and nonstructural) used to prevent erosion and control sedimentation, which could lead to stormwater leaving the construction site and degrading the water quality of receiving water bodies. Fundamental BMPs shall be those stated in the FERC Procedures and the FERC Plan.

As part of the NPDES permit program, a 1200-C stormwater construction permit will be obtained from the Oregon Department of Environmental Quality (ODEQ). The 1200-C permit requires the preparation and implementation of an EPSCP. The EPSCP will describe in detail the BMPs that will be selected and implemented prior to, during, and after construction. The BMPs described in this SWPPP will be included in the EPSCP. The following guidelines will be used in the selection, design, and implementation of BMPs:

- The construction-phase erosion and sediment controls will be designed to prevent and minimize erosion and retain sediment onsite to the extent practical, and to ensure that no significant changes occur in the volume or characteristics of stormwater runoff to receiving waters.
- All erosion and sediment control measures will be properly selected, installed, and maintained in accordance with the manufacturer's specifications and good engineering practices.
- If sediment-laden stormwater is conveyed beyond the construction site, controls will be used to minimize offsite impact, and additional BMPs will be implemented to prevent further migration offsite.
- Litter, construction debris, temporary stockpiles, exposed soil, and construction chemicals exposed to stormwater will be prevented from becoming pollutant sources for stormwater discharges.

3.1 Erosion Prevention and Sediment Controls

Erosion prevention and sediment controls that will be implemented include the following:

- **Runoff Controls**
  - Diversion of run-on
  - Minimizing total suspended solids (TSS) during instream construction
  - Instream diversion techniques
  - Instream isolation techniques
- **Erosion Prevention**
  - Scheduling
  - Preserving of existing vegetation
  - Topsoiling
  - Temporary and permanent seeding and planting
  - Mulching
- **Sediment Control**
  - Sediment fence
  - Compost berms and socks
  - Fiber rolls or wattles
  - Temporary sediment basin
  - Entrance/exit tracking controls
  - Entrance/exit tire wash
  - Minimizing TSS during instream construction

  - Instream diversion techniques
  - Instream isolation techniques

- **Nonstormwater Pollution Control**
  - Dewatering and ponded water management
  - Vehicle and equipment cleaning
  - Vehicle and equipment fueling, maintenance, and storage
  - Material delivery and storage controls
  - Material use
  - Stockpile management
  - Spill prevention and control procedures
  - Solid waste management
  - Hazardous materials and waste management
  - Sanitary waste management
  - Liquid waste management
  - Training and signage

The BMPs identified in this SWPPP represent the minimum requirements that will be documented in the EPSCP and implemented during construction. As construction progresses, additional BMPs will be implemented as needed to remain in compliance with the 1200-C construction general stormwater permit.

All BMPs will be installed per manufacturer's recommendations and good engineering practices. All BMPs will be maintained in effective operating condition. Routine inspections, as discussed in Section 4, will be performed to confirm that the erosion and sediment control BMPs are effective, to identify problems with existing BMPs, and to identify the need for changes in BMPs. Maintenance activities will be performed as needed.

Properly operating BMPs will be maintained to ensure continued effectiveness. When BMPs are not operating properly, maintenance will be performed within 24 hours (if practical) or at least before the next storm event, as necessary to maintain the continued effectiveness of stormwater controls. If maintenance prior to the next anticipated storm event is impractical, maintenance will be accomplished as soon as practical. If implementation before the next storm event is impractical, the situation will be documented in the inspection report and alternative BMPs will be implemented as soon as practical. BMPs that may be used for this Project are included in Attachment 1. The pages in Attachment 1 were taken from Appendix D of the *Oregon Department of Environmental Quality Erosion and Sediment Control Manual* (ODEQ, 2005).

3.2 Shoreline Stabilization

3.2.1 Shoreline

Concern has been expressed about potential impacts on aquatic habitats through alterations of nearshore environments at the Terminal. Based on anticipated activities during Terminal construction and operation, no special shoreline stabilization measures are proposed. No hard armoring of the shoreline is planned. Berm construction and maintenance will occur above the high tide elevation, and site rehabilitation measures for temporary impacts generally will occur away from the shoreline environment.

Ships traveling through the Columbia River Estuary produce waves and an uprush. Wave characteristics on beaches with slopes less than 5 percent exhibit total wave excursion across the beach face, from maximum drawdown to maximum run-up, ranging from 11.8 to 256 feet.[1] Drawdown refers to the condition in which the water moves down the beach slope away from the still water line. Run-up or surge refers the condition in which,

[1] Pearson, W.H., J.R. Skalski, K.L. Sobocinski, M.C. Miller, G.E. Johnson, G.D. Williams, J.A. Southard, and R.A. Buchanan. 2006. *A Study of Stranding of Juvenile Salmon by Ship Wakes along the Lower Columbia River using a Before and After Design: Before-Phase Results*. PNNL-15400, Prepared for the U.S. Army Corps of Engineers, Portland District, by Pacific Northwest National Laboratory, Marine Sciences Laboratory, Sequim, Washington.

after drawdown, the water returns up the beach slope, moving past the initial still water line and continuing up the beach slope. Run-up and drawdown distances tend to be slightly different, with a mean run-up of 30.5 feet and drawdown of 41.3 feet. The maximum vertical extent (drawdown height to run-up height) of ship waves ranged from about 0.3 to over 2.3 feet, with a mean of 0.8 feet. However, susceptibility of shorelines in the lower 10 miles of the Columbia River to high run-up and drawdown distances is minimal (W.H. Pearson, W.C. Fleece, K. Gabel, S. Jenniges, and J.R. Skalski. 2008. Spatial Analysis of Beach Susceptibility for Stranding of Juvenile Salmonids by Ship Wakes, Final Report. ENTRIX, Inc., Olympia, WA).

During Terminal operation, LNG vessels will produce negligible shoreline impact because they will move relatively slowly under limited maneuvering power with tug assist. Tugs will be high powered, and have potential to cause shoreline erosion when pointing their screws at the shore. However, the Terminal dock is almost 3,000 feet from dry land, so the probability of increased shoreline erosion caused by tugs is low. Tidal mudflats are closer to the dock and more exposed; however, the probability of increased erosion at mudflats is low outside the dredge area, especially if side slopes are 5:1 (horizontal:vertical), as planned.

Ambient significant wind-wave heights at the dock range from 0.61 to 3.64 feet for a 1-year return interval storm event, and from 1.61 to 5.68 feet for a 100-year return interval storm event, depending on wind direction.[2] Ship-wave energy should not exceed ambient wind-wave conditions.

If shoreline erosion monitoring during Terminal operations determines that potentially damaging erosion is occurring and that stabilization measures would reduce erosion potential, appropriate measures would be implemented pursuant to federal and state removal/fill approvals. Emphasis would be placed on soft armoring techniques, such as vegetation and brush layering.

3.2.2 Dunes

Temporary impacts to soil surfaces at the Terminal site will be rehabilitated using methods described in the previous section, and wetland rehabilitation techniques described in Resource Report 2. Much of the existing ground surface at the Terminal site is exposed and unvegetated, resulting from droughty, excessively drained dune sands and infertile conditions of dredge spoil. A significant proportion of the Terminal site soil has poor revegetation potential and high erosion potential. Although stability improvement of exposed surface soils that are temporarily disturbed to conditions equal to or better than preconstruction conditions may be impractical, the following site-specific, supplemental EPSCP BMPs should be considered:

- Crimping of straw mulch and reapplication of mulch, if necessary prior to vegetation establishment to ensure appropriate erosion control
- For plantings/seedings outside of the winter wet period (November-March), provide temporary or permanent irrigation to ensure rapid establishment

3.3 Streambank Stabilization

3.3.1 Minimizing Disturbance during the Construction Phase

The following EPSCP BMPs shall be used at stream crossings:

- Limit clearing of vegetation to the temporary and permanent easements.
- Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, if possible. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.
- Limit use of equipment operating in the waterbody to that needed to construct the crossing.

[2] Coast & Harbor Engineering. 2007. *Technical Report—Draft Oregon LNG Facility Coastal & Hydraulic Modeling Study*. Coast & Harbor Engineering, Edmonds, WA.

- All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed at least 10 feet from the water's edge or in additional extra work areas.
- Use sediment barriers to prevent the flow of spoil or heavily silt-laden water into any waterbody. Install sediment barriers immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or until restoration of adjacent upland areas is complete.
- Install sediment barriers across the entire construction easement at all waterbody crossings, where necessary to prevent the flow of sediments into the waterbody. In the travel lane, these may consist of removable sediment barriers or driveable berms. Removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day or when heavy precipitation is imminent.
- Where waterbodies are adjacent to the construction easement, install sediment barriers along the edge of the construction easement as necessary to contain spoil and sediment within the construction easement.
- Use trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the Pipeline trench and to keep any accumulated trench water out of the waterbody.
- At dam and pump and flume crossings, prevent streambed scour at pump discharge.

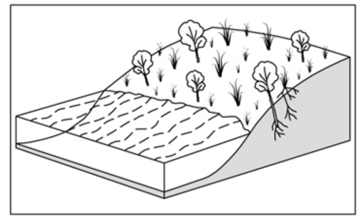
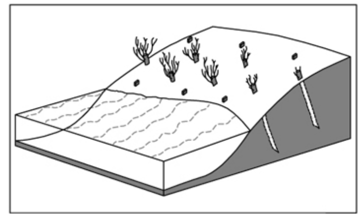
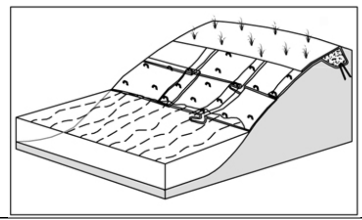
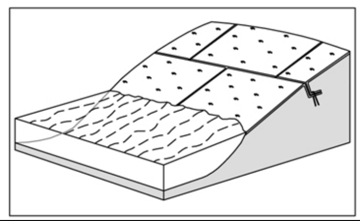
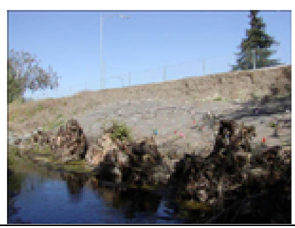
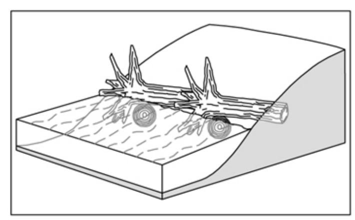
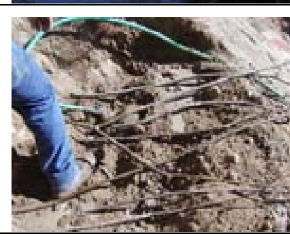
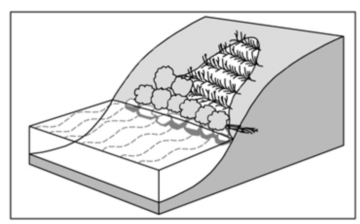
3.3.2 Streambank Stabilization

The following Streambank Stabilization BMPs shall be used after construction at all stream crossings, whether perennial or not flowing at the time of construction:

- Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.
- For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.
- Return all waterbody banks to preconstruction contours or to a stable angle of repose, as approved by the Environmental Inspector.
- Employ primarily bioengineering techniques for bank armoring and protection. Apply site-specific BMPs, such as those described by McCullah and Gray.[3] Examples of streambank stabilization techniques that can be adapted to site conditions are provided in Table 2.
- Riprap shall not be used for bank stabilization unless a geotechnical or environmental engineer determines that alternative soft armoring methods will be inadequate. If riprap is used, it shall be limited to the minimum required stream length.
- Revegetate disturbed riparian areas with conservation grasses and legumes or native plant species, preferably woody species.
- Install a permanent slope breaker across the construction easement at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody.
- At dam and pump and flume crossings, repair unavoidable streambed scour at pump discharges with clean gravel.
- Remove all non-native materials from the crossing after construction and stabilization are complete.

[3] McCullah, John and Donald Gray. 2005. *Environmentally Sensitive Channel- and Bank-Protection Measures*. National Cooperative Highway Research Program, Transportation Research Board, Washington, DC. NCHRP Report 544.

TABLE 2
Example Techniques for Bank Armor and Protection (after McCullah and Gray, 2005)

Vegetation Alone	Vegetation is established on bare soils to help prevent surficial erosion, minimize shallow seated mass movement, provide habitat, and enhance aesthetics or visual appearance.		
Live Staking	Used for revegetation, soil reinforcement, and anchoring erosion control materials. Willow cuttings are typically 1.5 – 3.3 ft long. The portion of the stem in the soil will grow roots and the exposed portion will develop into a bushy riparian plant.		
Turf Reinforcement Mats	Long lasting, designed to resist shear and tractive forces, and specified for banks subjected to flowing water. Mats are UV fibers in a three-dimensional matrix. TRMs work with plant roots and shoots to be mutually reinforcing.		
Erosion Control Blankets	Temporary rolled erosion control products consisting of flexible nets or mats, manufactured from both natural and synthetic materials, usually straw, wood, excelsior, or coconut. Various grades of biodegradable fibers and netting available.		
Rootwad Revetments	Interlocking tree materials, continuous and resistive. Primarily intended to resist erosive flows, usually on the outer bank of a meander bend when habitat diversity is desirable and woody materials are available.		
Live Gully Fill Repair	Alternating layers of live branch cuttings and compacted soil. This reinforced fill can be used to stabilize trench backfill. Suitable for filling and repairing elongated voids in a slope.		

3.4 Stabilization

Appropriate BMPs will be implemented and maintained at the construction site from the initiation of construction through final stabilization. “Final stabilization” refers to the time when all soil-disturbing activities at the site have been completed and one of the following criteria has been met:

- The area has been compacted, surfaced, or built upon for final use.
- Permanent planting and seeding have been established.

- Equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been used.
- In land used for agricultural purposes (such as crop or range land), the disturbed land is returned to its preconstruction grade for potential agricultural use.

3.5 Stockpile Management

Numerous BMPS will be implemented and maintained at the construction site to adequately manage stockpiles created during construction. To facilitate installation of the Pipeline and various components, excavations will be created. The soil from these excavations will be temporarily stockpiled and used as backfill over the Pipeline and associated components. Stockpile management will consist of the following:

- While the material is stockpiled, silt fencing or straw wattles will be used as perimeter control.
- Stockpiled material will be covered with a thick layer of mulch or by plastic sheeting that is adequately anchored. Inactive stockpiles will be covered immediately. Active stockpiles will be covered at the end of each work week, or if inclement weather is forecasted.
- Stockpiles from trenching must be kept a minimum of 25 – 30 feet from streams.
- Stockpiles will also be constructed to have stable slopes to prevent the potential for erosion.

3.6 Environmental Inspector

One Environmental Inspector (EI) will be assigned per construction spread to help with stormwater management. The EI will also act as the designated site inspector required by the 1200-C permit. The EI must be an individual who is qualified and knowledgeable about erosion and sediment control installations, practices, and inspections. Each EI will be responsible for ensuring that contractors meet the goals of the SWPPP and EPSCP, and also for BMP installation and maintenance.

The EI will update this SWPPP and the EPSCP when the need for modifications of site-specific BMPs (or the use of additional or different BMPs) is identified; the EI will maintain a log and will note these changes. The EI will also be responsible for conducting site inspections once per week, and within 24 hours of a rain event that creates stormwater runoff. The requirements of these inspections are discussed in Section 4.

Any modifications or changes to the selected BMPs will be implemented within 24 hours, if practical. Otherwise, the changes will be implemented as soon as practical before the next storm event. The situation will be documented in the inspection report, and one or more alternative BMPs will be implemented as soon as practical. Modifications to major BMPs (such as sediment basins) at a site will be noted on the site diagrams within 7 days, and submitted to ODEQ in the form of an Action Plan. These changes will also be noted in the site SWPPP and EPSCP.

SECTION 4.0

Maintenance and Inspection Procedures

The EI will perform inspections throughout construction until all disturbed areas of the construction site reach final stabilization. The EI will be listed as the designated site inspector as part of the 1200-C permit. The EI is a person who:

- Is knowledgeable in the principles and practice of erosion and sediment control
- Possesses the skills needed to assess conditions at the construction site that could affect stormwater quality
- Possesses the skills needed to assess the effectiveness of any sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity
- Is familiar with this Project and this SWPPP

Furthermore, the EI must be an individual who:

- Is a Certified Professional in Erosion and Sediment Control; or
- Is a Certified Erosion and Sediment Control Lead; or:
- Can document having at least 200 hours of on-the-job-experience associated with installation, maintenance, and selection of BMPs

4.1 Areas to Be Inspected

Inspections will include all areas of the site disturbed by construction activity and areas used for storage of materials. This includes, but is not limited to: construction areas that have not reached final stabilization, areas used for storage of materials that are exposed to precipitation (prevents inspection at a warehouse site), staging areas, temporary contractor yards, access roads, structural controls, locations where vehicles enter or exit the site, waterbody crossings, and locations of the withdrawal and discharge to the extent practical.

The receiving waterbody will be inspected upgradient, downgradient, and in areas where stormwater enters the receiving waterbody. At each of these locations, visual observations of the stormwater will be documented.

If part of the construction area has reached final stabilization, the site will be recorded and mapped as final. Inspections will be discontinued upon confirmation of final stabilization.

4.2 Inspection Schedule

Inspections will be completed on a daily basis in active areas of construction. In inactive construction areas, inspections will take place weekly or within 24 hours of a significant precipitation event that could create stormwater runoff. Inspections will be performed until final stabilization is achieved in all disturbed areas.

4.3 Disturbed Areas

EIs will inspect disturbed areas of the construction corridor, storage areas that are exposed to precipitation events, structural control measures, and high-traffic areas. Sediment and erosion control measures will be inspected to confirm that they are operating properly. Areas of entrance and egress for Project traffic will be inspected for evidence of offsite sediment tracking. Inspections in disturbed areas will continue until final stabilization has occurred.

4.4 Inspection Content and Activities

Inspections will be conducted as follows:

- Inspect all control measures. All control measures will be maintained in good working order. When repair is necessary, it should begin within 24 hours after the deficiency is noted. If weather or other factors prevent initiation of corrective actions within 24 hours, the corrective action will be completed as soon as practical.
- Inspect all disturbed areas for evidence of or potential for pollutants entering the drainage system. Sediment from silt fences should be removed regularly and the fences inspected to ensure that the bottom remains embedded in the ground. Damaged straw wattles or compost socks will be replaced as necessary.
- Inspect all material storage areas, where materials are exposed to precipitation, for evidence of or potential for pollutants entering the drainage system.
- Inspect areas of vehicle entrance and egress for evidence of offsite sediment tracking.
- Inspect all discharge points, if accessible, to determine whether erosion control measures are effective in preventing significant impacts on receiving waters. If these points are inaccessible, inspect nearby downstream locations.
- Visually observe and document the receiving water bodies, both upgradient and downgradient from the active construction areas. These observations should include color, odor, presence or absence of floating materials, debris, sheens, oil, and grease.
- Inspect vegetation to determine the success of revegetation.
- Document each inspection with an inspection report completed after each inspection.
- Update the site diagrams to show current BMPs.

SECTION 5.0

Plan Modification

This SWPPP may be modified based on the results of routine inspections and visual monitoring of the receiving water bodies. Modifications may address additional or modified BMPs designed to correct identified deficiencies. Modifications will be completed within 7 days after the inspection. Any modifications resulting in additional BMPs or in replacing of ineffective BMPs will be submitted to ODEQ in the form of an Action Plan. If existing BMPs need to be modified, the work will be completed as soon as practical.

SECTION 6.0
Required Reports, Documents, and Record Keeping

A copy of this SWPPP and the EPSCP will be maintained at the construction headquarters for each construction section. Construction activity records, including inspection, monitoring, and maintenance reports and erosion control maintenance records, will be maintained. At a minimum, records of the following will be kept:

- Weekly summaries of construction activities
- Periods when major grading or excavation activities occur
- Completions of temporary or permanent construction activities
- Date(s) when an area is stabilized, on either an interim or a final basis
- Functionality of all installed BMPs
- Date(s) when maintenance of installed BMPs occurred
- Any modifications to the selected BMPs
- Results of visual inspections

All documentation associated with this SWPPP and EPSCP will be maintained for a period of 3 years from the date on which final stabilization of the site has been achieved.

SECTION 7.0

Spill Prevention, Containment, and Countermeasures Plan

7.1 Planning and Prevention

This Spill Prevention, Containment, and Countermeasures Plan (SPCC Plan) provides preventive and mitigative measures to be used by Oregon LNG and its contractors during construction of the Pipeline.

The measures detailed in the subsequent sections of this SPCC Plan are intended to minimize the possible environmental impact associated with spills or releases of fuels, lubricants, or hazardous materials during routine upland construction and refueling activities. The HDD Frac-out Contingency Plan (Chapter 8) includes measures that will be taken during HDD installations in the event of a “frac-out,” which could lead to the possible release of drilling fluids.

The location of fuel storage facilities, fueling activities, and construction equipment maintenance along the construction easement are defined and included in the subsequent sections. The procedures, materials, and lines of communication to facilitate prevention, containment, and cleanup of spills during construction are discussed in the following subsections.

The SPCC Plan includes the minimum standards for storing and handling regulated substances. The contractors who participate in construction and/or restoration activities associated with construction of the Pipeline will adopt and implement the SPCC Plan for all aspects of construction.

The goal of the SPCC Plan is to minimize the potential for a fuel, lubricant, or hazardous materials spill; to contain any spillage to the smallest area practical; and to protect areas that are considered environmentally sensitive.

7.2 Roles and Responsibilities

The EI will verify that all Project contractors implement the measures outlined in this SPCC Plan. Other roles and responsibilities are outlined below:

- The contractors will be responsible and accountable for their activities and the activities of their subcontractors with respect to environmental regulations and applicable requirements. This includes all regulatory requirements for spill prevention, response, agency notification, and cleanup. All contractors and subcontractors will comply with this SPCC Plan.
- The EI will provide environmental spill prevention and containment training to all appropriate construction personnel.
- Each contractor and subcontractor will ensure that all their personnel involved in fueling and maintenance activities will receive SPCC specific training and carry appropriate response equipment before beginning work on the Project. Each contractor will maintain appropriate training documentation for all fueling and maintenance personnel.
- Each contractor will designate an independent contractor that is an expert in environmental cleanup (Emergency Response Contractor [ERC]). The ERC will respond immediately to any and all remediating spill events that are considered beyond the capabilities of the contractor. Attachment 2 contains the ERC contact information, as well as contact information for other members of the emergency response team.
- Material safety data sheets (MSDSs) for all chemicals brought onto the construction site will be kept onsite.
- The contractor will be considered the Waste Generator for all spills caused by construction activity.
- The contractor will identify all approved waste transporters and disposal sites for hazardous and nonhazardous materials that are located in the proximity of construction activities.

- The contractor will prepare a written inventory of all approved waste transporters and disposal sites for both hazardous and nonhazardous wastes near construction activities.

7.3 Project Materials

Within 1 week after mobilizing to the Project site, the contractor will submit to the EI a written inventory of lubricants, fuels, and other materials planned to be on the job site or stored within the easement and construction laydown area(s). The written inventory will also include the reportable quantities for each of the identified materials. For this type of construction Project, materials stored onsite will include diesel and gasoline, various oils and lubricants, antifreeze, paints, and fertilizers. Table 3 shows typical hazardous substances onsite for construction projects. One week after mobilization, the exact quantities stored within the easement and laydown areas will be known, and this table will be revised in the field copy of the SWPPP.

TABLE 3
Typical Fuels, Lubricants, and Hazardous Materials

Product	Typical Quantity[a]	Method of Storage	Storage Location
Diesel Fuel	5,000-10,000	Tank or tankers	Contractor yard warehouse
Gasoline	5,000-10,000	Tank or tankers, 5-gallon containers, vehicle tanks	Contractor yard warehouse
Engine Oil	<100	Bulk storage or retail packaging	Contractor yard warehouse
Transmission Drive Train Oil	<50	Retail packaging on service trucks	Contractor yard warehouse, service trucks
Hydraulic Oil	<100	Bulk storage or retail packaging	Contractor yard warehouse, service trucks
Gear Oil	<50	Retail packaging on service trucks	Contractor yard warehouse, service trucks
Lubricant Grease	<25	Tubes stored in paper cases	Contractor yard warehouse, service trucks
Ethylene Glycol	<100	Bulk storage or retail packaging	Contractor yard warehouse, service trucks
Propylene Glycol	<100	Bulk storage or retail packaging	Contractor yard warehouse, service trucks
Power Steering Fluid	<50	Retail packaging on service trucks	Contractor yard warehouse, service trucks
Brake Fluid	<50	Retail packaging on service trucks	Contractor yard warehouse, service trucks
Propane	25-100	Pressurized tanks	Contractor yard warehouse, service trucks
Paint	<50	5-gallon containers	Contractor yard warehouse
Fertilizers	<500 pounds	50-pound bags	Contractor yard warehouse

[a] Units are gallons except as noted.

7.4 Spill Prevention and Mitigation Measures

BMPs will be implemented to prevent spills. BMPs will be used to reduce the risk of spills and other accidental exposures that could potentially result in impacts to stormwater quality. Good housekeeping BMPs will be implemented during all phases of construction to prevent spills, as feasible. Good housekeeping BMPs include the following:

- Container Storage
- Secondary Containment
- Leak and Integrity Inspections
- Fueling and Material Handling
- Materials on Hand
- Restricted Fueling Areas
- Restricted Areas
- Material Specific Procedures

7.4.1 Container Storage

The following structural and nonstructural BMPs will be implemented to prevent the direct release of any product (hazardous or nonhazardous):

- Only enough products required to do the job will be brought onto and stored within the site.
- Product will be stored only in containers sized appropriately for the job.
- All storage will occur more than 150 feet from any surface water (including wetlands).
- No storage will occur within 200 feet of a private water supply well, or within 400 feet of a municipal water supply well.
- All fuel or hazardous material containers of 55 gallons or more will be stored in designated work areas equipped with secondary containment.
- All product will be stored in containers that are in good condition.
- All product containers will be stored underneath a roof or cover to prevent release of materials during a storm event.
- All product containers will be stored in a neat and orderly fashion, and will be properly labeled. The labels will be visible, correct, and legible.
- The inventory of all MSDSs for each chemical will be available at each storage location.
- Products will be kept in original containers with the original manufacturer’s label still affixed. If the original container is not resealable, then the product will be transferred to an appropriate container that is properly labeled.
- Drain valves on any temporary storage tanks will be locked to prevent accidental or unauthorized discharges.
- Whenever practical, all contents of a container will be used before it is disposed of.
- Any surplus product must be disposed of in accordance with the manufacturer’s and state and local methods for proper disposal.

7.4.2 Secondary Containment

- Secondary containment will provide a minimum containment volume equal to 100 percent of the volume of the largest storage vessel and will include at least 1 foot of freeboard.
- Earthen secondary containment areas will be underlined with plastic sheeting (minimum of 60-mil).
- Polyethylene drum spill skids will be used for storage of 55-gallon drums of fuel or hazardous materials that may be placed temporarily in the immediate work area.
- The contractor will construct temporary liners and seamless berms around aboveground bulk storage tanks.
- Secondary containment structures will be constructed as dictated by the construction design drawings. Any uncontaminated accumulated precipitation within the secondary containment may be discharged if authorized by an EI, based on the absence of visible sheen. Accumulated precipitation that has a visible sheen will be collected for proper storage and disposal.

7.4.3 Leak and Integrity Inspections

The contractor will be responsible for daily leak inspection and for the integrity of all construction equipment and vehicles and material storage areas (including secondary containment structures):

- The contractor will visually inspect aboveground tanks daily, and whenever the tank is refilled.

- The contractor will repair visible leaks in tanks immediately. Tanks with leaks will not be refilled until repaired and tested.
- All onsite construction equipment and vehicles will be inspected for leaks daily.
- During construction activities, contractor personnel will conduct leak and integrity inspections of equipment, vehicles, secondary containment areas (tank and drum storage areas), and spill response supply areas.

7.4.4 Fuels and Hazardous Materials Handling

Specific procedures and practices will be implemented during construction activities to prevent the release of fuel or hazardous materials. The following nonstructural and structural BMPs will be implemented:

- Fuels and lubricants will be stored only at designated staging areas and in appropriate service vehicles. The storage area will be at least 150 feet from the edge of the nearest waterbody (including wetlands), at least 200 feet from the nearest private water supply well, and at least 400 feet from the nearest municipal water supply well
- The drivers of tank trucks are responsible for spill prevention during tank unloading. Procedures for loading and unloading tank trucks will meet the applicable minimum requirements established by the U.S. Department of Transportation. Drivers will observe and control fueling operations at all times to prevent overfilling.
- The drivers of tank trucks will inspect all outlets of the vehicle prior before they leave the construction site to prevent leakage while in transit.
- All fuel nozzles will be equipped with functional automatic shut-off valves.

7.4.5 Materials on Hand

Spill response equipment will be stored onsite in the designated fueling areas and at designated locations throughout the Project area. The minimum materials will be stored onsite:

- A sufficient supply of sorbent and barrier materials will be kept at the construction staging areas to allow the rapid containment and recovery of a spill.
- Sorbent and barrier materials will also be used to contain runoff from spill areas.
- Shovels and labeled 55-gallon drums will be kept at each staging area.
- Small quantities of soil that has become contaminated within the staging areas will be collected and placed in the drums.
- Large quantities of contaminated soil will be collected using heavy equipment and stored in properly labeled drums or other suitable containers prior to disposal. Emergency spill response materials will also be located within the designated areas.

7.4.6 Restricted Areas

The following restrictions apply for all construction activities within the easement:

- The contractor will refuel equipment and transfer material only in designated areas. The designated areas must be away from all water resources. The minimum distances that must be adhered to are as follows:
  - 150 feet away from any and all surface water sources (including wetlands, ephemeral streams, seasonal streams, lakes, and rivers)
  - 200 feet away from any private water supply well
  - 400 feet away from any municipal water supply well

- The contractor will conduct routine equipment maintenance, such as oil changes, in staging areas. The contractor will dispose of waste oil in an appropriate manner.
- Equipment will not be washed in streams or within 150 feet of water bodies, including wetlands.

7.4.7 Restricted Refueling Areas

In addition to the restrictions noted in the previous section, all refueling activities will also adhere to the following conditions:

- The EI will verify that signs are in place identifying restricted areas.
- In large wetlands where no upland site is available for refueling, auxiliary fuel tanks may be mounted on equipment to minimize the need for refueling.
- Personnel trained in these spill prevention and mitigation procedures will be available for refueling in these areas.
- Auxiliary tanks will be mounted on or affixed to equipment such as large, stationary pumps as appropriate. The auxiliary tanks will be placed within secondary containment.
- Refueling within restricted areas will take place in designated areas. Fuel trucks with a capacity in excess of 300 gallons will not be permitted within the refueling areas unless adequate secondary containment is provided.
- Refueling of any portable equipment will be performed using approved containers with a maximum volume of 5 gallons.

7.4.8 Other Material-Specific Measures

- Paints: Containers will be tightly sealed and stored in the designated area. Paint containers will not be left outside of the designated storage area. Excess paint will be properly disposed of according to manufacturer's instructions and federal, state, and local regulations.
- Concrete Trucks: Concrete trucks will be allowed to wash out or discharge surplus concrete or drum wash water on the site in designated areas only. The designated concrete washout area will include sediment controls installed around the perimeter of the area. This area must be at least 150 feet away from any surface water feature. After construction, the concrete washout area will be restored.

7.5 Spill Preparedness Practices

The following preparedness BMPs will be implemented during the Project:

- Each contractor will know the RQ for all materials onsite.
- Fuel and service trucks will carry adequate spill response materials, including suitable commercial absorbent and barrier materials.
- The contractor will determine whether additional spill response material is required, based on volume and level of hazardous materials transported, proximity of refueling equipment to sensitive areas, and any other unforeseen factors that could increase the likelihood, impact, or size of potential releases.

7.6 Spill Response Procedures

7.6.1 Initial Spill Management

Immediately upon any spill of fuel, oil, hazardous material, or other pollutant, the person discovering the situation will initiate the following actions:

- Assess the safety of the situation; if necessary, call the Supervisor immediately for help.

- If conditions are not safe, block access to the spill site and/or evacuate the area.
- If conditions are safe, the initial response should include:
  - Remove sources of ignition.
  - Shut off the source of the spill.
  - Begin spill containment.
- Notify the Supervisor and the EI.
- For any release or spill (regardless of volume) in designated vulnerable aquifer areas, immediately notify Oregon LNG's representative and the EI. Spill containment response actions will be followed, all affected soils will be immediately excavated, and affected soils will be stored and disposed of in accordance with the procedures outlined in this SPCC Plan.

7.6.2 Mobilization of Additional Resources

Other resources may be mobilized at the discretion of the highest-ranking responder. Resources will be mobilized as follows:

- Based on the severity of the situation, the Supervisor will notify local emergency response agencies (e.g., police or fire department).
- The Supervisor will immediately notify Project inspectors (Oregon LNG Project Manager and EI) and all applicable contractor supervisors and/or managers of any spill, except minor spills that have been managed by the first responder. Specifically, a spill is exempt if it has:
  - No potential to be reportable
  - No potential or actual impact on the environment
  - No potential to cause other liabilities
- If spill containment and cleanup are beyond the capabilities of the contractor, the ERC will clean up the spill.
- If the spill or response is likely to affect the operation of existing facilities, the Oregon LNG Project Manager will be notified.
- The contractor will begin documenting the spill event, notifications, and response immediately.

7.7 Spill Containment and Cleanup

It is Oregon LNG's objective to restore land to its preconstruction condition. The procedures outlined below will be followed for containment and/or cleanup of spills:

- The type of material and quantity released will be identified and the response will be appropriately managed. Personal protective equipment will be worn as recommended on the MSDS of the specific product. All procedures will be in compliance with Hazardous Waste Operations and Emergency Response standards, as applicable.
- Oregon LNG will be consulted by the EI and/or the contractor for any spill requiring implementation of this SPCC Plan.
- Containment will be initiated as soon as it can be safely performed. A spill on dry ground will require the construction of berms (earthen dikes) to contain the spill. Commercially available spill kits will be used and sorbent materials will be applied to the spill area. Traffic on contaminated soils will be avoided.
- If the spill is large enough, where the material can be safely pumped into the appropriate container, then pumping will be implemented after containment is achieved.
- Removal of soil and spilled material will rely on visual observations to determine the extent of removal. Soil and spilled materials will be removed until no visible evidence of spilled materials remains.

- All spills will be cleaned up and removed to the satisfaction of the EI and Oregon LNG personnel.
- Contaminated soils and vegetation will be stored in appropriate and properly labeled containers, and managed appropriately until they are disposed of at an approved facility.

7.7.1 Wetlands or Waterbody Response

For any spill (regardless of volume) that occurs near or into a waterbody (stream, wetland, river, or other type of waterbody), the following specific actions must be applied. The procedures are in addition the ones described above in this Plan:

- For reportable spills into streams, lakes, or other water bodies containing standing or flowing water, the responder will immediately notify the EI and Oregon LNG personnel.
- For a spill threatening a waterbody, berms and/or trenches will be constructed to contain the spill prior to entry into a waterbody. The spilled product will be removed and the contaminated area cleaned up in accordance with procedures referenced in this SPCC Plan and applicable state and local guidelines.
- If a spill enters surface water, containment booms or other containment methods will be implemented. Product will be removed with a vacuum truck or pumps and stored in appropriate containers.
- Contaminated soil in wetlands will be excavated and placed in an approved containment area (berms, underlined with plastic, and covered and anchored) a minimum of 150 feet from the wetland or waterbody.

7.8 Material Disposal

As soon as practical, the Contractor will dispose of contaminated soil or water and any other materials associated with spill containment and cleanup at an approved disposal facility.

- The Contractor will supply Oregon LNG with all documentation concerning the disposal of contaminated media.

SECTION 8.0

Horizontal Directional Drilling Frac-out Contingency Plan

This Horizontal Directional Drilling Frac-out Contingency Plan is a supplement to the SPCC Plan and provides specific preventive and mitigative measures to be used by Oregon LNG and its contractors during HDD installation. This is a preliminary plan, and more specific procedures will be developed during final design for each location based on site-specific conditions. HDD operations potentially pose a risk to wetlands and water bodies through frac-outs. A frac-out occurs when the drilling fluid is released through fractured bedrock and sands. Drilling fluid typically consists of a mixture of bentonite, water, and soil cuttings. This mixture is not hazardous or toxic, but it could potentially affect the water quality of any waterbody if it were introduced.

Frac-outs can occur at any place along any point of an HDD installation, although they are more likely to be observed at the entry and exit points (locations where the drilling bit or head is shallow). If a frac-out occurs and no control measures are in place, the drilling fluid could potentially reach the surface water or wetland that is above the HDD installation. The contingency plan detailed in the following subsections will outline measures to minimize the potential for frac-outs. This plan also addresses the methodology that will be used for detection of frac-outs, as well as countermeasures to be taken should a frac-out be detected.

8.1 Planning and Prevention

HDD crossings will be conducted only during recommended in-water work periods to minimize impacts from potential frac-outs. Oregon LNG will use nontoxic bentonite-clay mixtures of drilling mud to ensure that, if a frac-out occurred, it would not result in toxicity to aquatic life in the stream.

The contractor performing the HDD must have experienced personnel onsite who are familiar and experienced with the procedures for this type of installation. Before drilling activities begin, the contractor must submit any certifications and documentation of at least 2 years of experience for all personnel who will be performing drilling work. The EI must be present for all HDD activities. Before any HDD occurs, a safety meeting will take place, the frac-out contingency plan will be discussed, and any questions will be answered.

Prior to drilling, the work area(s) will be flagged and the limits defined. The work area will not exceed 10 feet on either side of the centerline of the proposed boring. Erosion and sediment controls (including silt fence, straw wattles, and temporary sediment trap) will be installed at the entrance/exit pits. Additional materials will be kept onsite at a designated location, and the presence of these materials will be verified prior to any drilling activities. These materials will be placed in a dedicated location and denoted as the frac-out containment response kit. The kit will include the following items:

- Silt fence
- Straw wattles
- Silt curtain (in-water work)
- Straw bales
- Submersible pumps
- Specialized filters
- Generator
- Appropriate hand tools
- Vacuum truck (available on call)
- Light towers for work at night
- Heavy equipment, such as backhoe or dozer, for containment and cleanup of drilling mud
- Boat for major waterbody crossings to allow for monitoring of releases to water

8.1.1 Frac-out Monitoring

Once HDD begins, specific monitoring will need to be done to determine whether a frac-out occurs. The bentonite mixture will be adjusted to match the conditions of the subsurface. The pressure levels will be set as low as possible, and they will be closely monitored to ensure that the pressure on the drilling fluid is set to match the formation. The pressure should not exceed what is needed to penetrate the formation.

During drilling, the pressures will be closely watched and randomly checked by the EI. As the boring progresses, the pressure will be inspected and documented. Any drop in the pressure could indicate a potential frac-out, and drilling will be halted immediately.

The drill mud will also be monitored, inspected, and documented. If there is a noticeable drop in the return of the drill mud, the drilling will stop immediately.

8.1.2 Frac-Out Response

Should the results of the monitoring indicate that a frac-out has occurred, the drilling will be stopped immediately, and the following procedures will be implemented:

- Slowly pull the stem back to relieve pressure on the potential frac-out.
- Wait for the drill mud to settle.
- Assess the situation to determine whether the frac-out has reached the surface.
  - If the frac-out has reached the surface, immediately implement containment and notifications, as discussed below.
  - If the frac-out has not reached the surface and is not threatening sensitive areas, use a leak-stopping compound to correct the frac-out.
- If the leak-stopping compound has been successful (100 percent containment), continue with drilling.
- If the leak-stopping compound has not been successful, redirect the boring to an area where a frac-out has not occurred.
- If the frac-out cannot be contained, abandon the borehole, as discussed below.

8.1.3 Surface Frac-Out Containment and Response

Should a frac-out occur and result in release to the surface, drilling will halt immediately and the severity of the release will be determined. If the release to the surface is minor, the following procedures will be implemented:

- Identify the extent of the release.
- Create a containment area with the use of a silt curtain, straw wattles, fiber rolls, and/or constructed earthen dikes.
  - If the frac-out release to the surface occurred upland or in riparian areas, allow the material to dry prior to excavation.
  - If the frac-out release to the surface occurred in a waterbody, immediately remove the material.
- For minor releases that are not widespread, remove bentonite-contaminated material with the use of hand tools to a depth of 2 feet.
- For larger releases, that are (or have the potential to be) widespread, mobilize the vacuum truck to remove the material. Place the submersible pumps within the release area to capture material until the vacuum truck arrives.
- Place excavated material in an appropriate container.
- Backfill with clean sand.

- Dispose of material at an approved facility and as required by regulations.

After successful containment and removal of the released material, operations will be able to continue (with the appropriate agencies' approval). All the activities associated with the frac-out response will be documented, and measures to prevent another release will be discussed. Before restarting drilling operations, the boring will be redirected to an area that has not had a frac-out, or the borehole will be abandoned.

8.1.4 Frac-Out Notifications

In the event of an HDD drilling fluid release to water bodies, sensitive areas, or riparian areas, appropriate local, state, and federal agencies will be notified. All appropriate agencies will be notified of the frac-out within 24 hours. The agencies that will be notified are presented in Table 4. The following information will be provided:

- Time of frac-out release
- Location of release
- Quantity and type of material released and amount of recovered materials
- Containment and cleanup measures
- Location of sensitive areas near the release

TABLE 4
Agency Contact List In the Event of a Frac-Out

Agency	Contact Person	Position	Location	Contact Number
Oregon Department of Fish and Wildlife	Chris Knutsen	North Coast Watershed District Fish Biologist		503.842.2741 ext 231
Oregon Department of Fish and Wildlife	Tom Murtagh/ Todd Alsbury	North Willamette Watershed District Fish Biologist		971.673.6011
Oregon Department of Forestry	Todd Reinwald	Assistant District Forester, Forest Grove District	Forest Grove	Office: 503.359.7493 Cell: 503.260.2057
Oregon Department of State Lands	Sarah Kelly	Resource Coordinator DOE Clatsop and Columbia Counties	Salem	503.986.5219
USEPA	Contacted by the National Response Hotline			
United States Fish and Wildlife Service	Mike Szumski,	NRDA Coordinator	Portland	503.231.6179
Washington Department of Fish and Wildlife	TBD	Regional Manager		
Washington Department of Natural Resources	TBD	Forest Practices Division Manager		

8.1.5 Borehole Abandonment

A borehole will need to be abandoned if a frac-out cannot be avoided, or if a frac-out has occurred that cannot be controlled. The borehole will be completely abandoned and a new location determined. Any borehole abandonment locations will be documented and shown on any as-built documents.

The following steps will be implemented during abandonment of the borehole:

- Determine the new location for the HDD crossing.
- Insert casing, as necessary to remove the pilot string.
- Pump a thick grout plug into the borehole to securely seal the abandoned borehole.

SECTION 9.0

Certifications

9.1 Oregon LNG Certification

To the best of my knowledge and belief, the information submitted in this SWPPP is true, accurate, and complete.

Signed: ______________________________ Date: ______________________

Print Name: ______________________________

Title: ______________________________

Company: ______________________________

9.2 Contractor/Subcontractor(s) Certification

To the best of my knowledge and belief, the information submitted in this SWPPP is true, accurate, and complete.

Signed: ______________________________ Date: ______________________

Print Name: ______________________________

Title: ______________________________

Company: ______________________________

Attachment 1
Best Management Practices Information

APPENDIX D

RUNOFF CONTROL BMPS

DIVERSION OF RUN-ON – RC-3

Diversion consists of measures that intercept, divert and convey surface run-on, generally sheet flow, to prevent erosion and transport of pollutants through and from the site.

Construction Specifications:

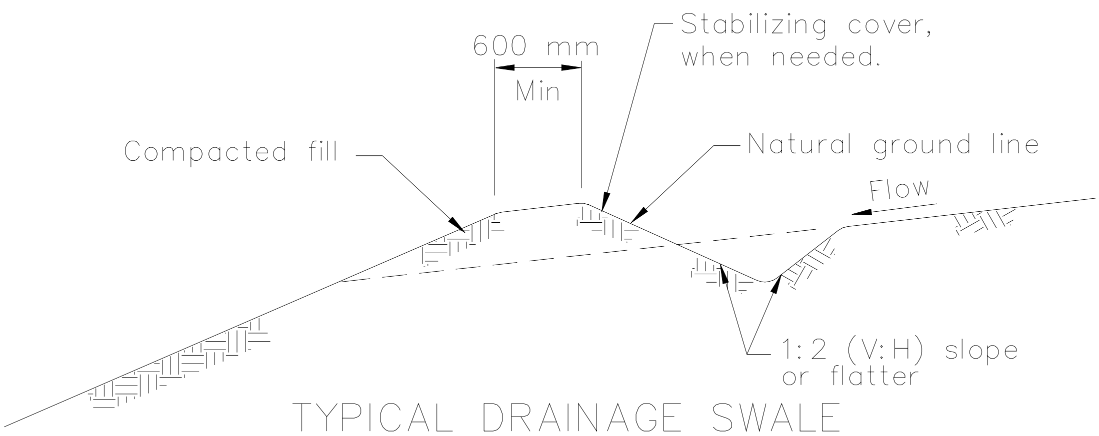
- Construct diversion channels consisting of drainage swales; earth dikes; or other means such as sand bag barriers to intercept and divert run-on to avoid sheet flow over sloped surfaces and work areas (See SC-2 "Sand Bag Barrier").
- Construct diversion structure to adequately convey storm flows based on careful evaluation of the risks due to erosion of the measure, soil types, over topping, flow backups, washout, and drainage flow patterns for each project site.
- Use other soil stabilization and sediment controls, such as check dams, plastics, and blankets, as necessary to prevent scour and erosion in newly graded dikes, swales and ditches.
- Correctly size and locate earth dikes, drainage swales and lined ditches. Excessively steep, unlined dikes and swales are themselves subject to erosion and gully formation.
- Stabilize conveyances as necessary and use a lined ditch for high flow velocities. Refer to EC-10 entitled "Erosion Control Blankets and Mats" or line with permanent, erosion-resistant material.
- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment/slope protection, or other temporary soil stabilization methods.
- Compact any fills to prevent unequal settlement.
- Divert runoff to an appropriate downstream location.
- Use level spreaders (i.e., outlets for dikes and flow channels consisting of an excavated depression constructed at zero grade across a slope), to convert concentrated runoff into sheetflow onto areas stabilized by existing vegetation.
- Do not divert runoff from the project to adjacent properties without permission.
- When possible, install and utilize permanent dikes, swales and ditches early in the construction process.
- Convey collected run-on/concentrated flows down slopes in accordance with the RC-1 ("Slope Drain")
- Provide stabilized outlets. Refer to RC-2 entitled "Energy Dissipator."

Minimum BMP standards are provided on the following detail.

Inspection and Maintenance:

- Inspect temporary measures before, during and after rain events, and regularly.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment, and repair linings and embankments as needed or as directed by the engineer.
- Temporary conveyances shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.

DIVERSION OF RUN-ON – RC-3

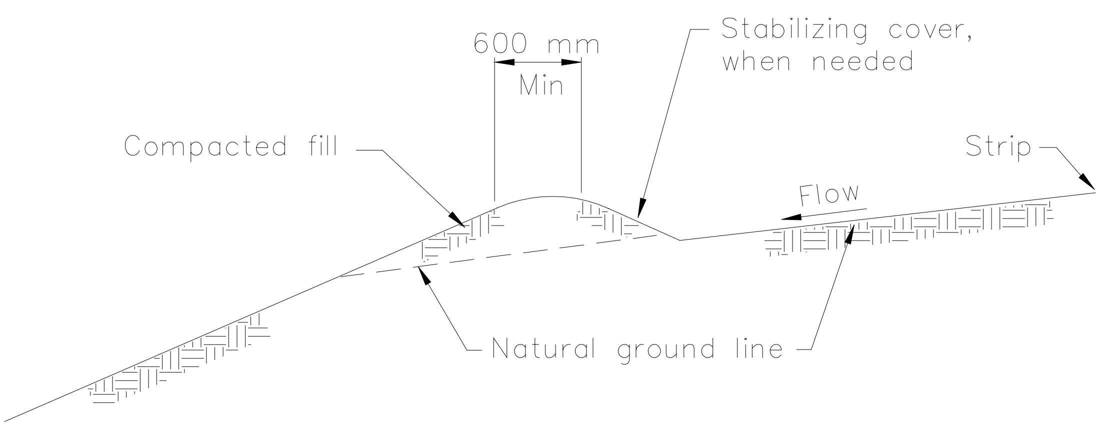


TYPICAL DRAINAGE SWALE

NOT TO SCALE

NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade, in conformance with Section 19–5 of the Caltrans Standard Specifications.



TYPICAL EARTH DIKE

NOT TO SCALE

Construction Specifications

Whatever technique you decide to implement, an important thing to remember is that dilution can sometimes be the solution. A probable “worst time” to release high TSS into a stream system might be when the stream is very low; summer low flow, for example. During these times, the flow may be low while the biological activity in the stream is very high. Conversely, the addition of high TSS or sediment during a big storm discharge might have a relatively low impact, because the stream is already turbid, and the stream energy is capable of transporting both suspended solids, and large quantities of bedload through the system. The optimum time to “pull” in-stream structures may be during the rising limb of a storm hydrograph.

Techniques to Minimize Total Suspended Solids (TSS)

Padding
Padding, usually manufactured from coir and or other natural fibers, that is laid in the stream below the work site may trap some solids that are deposited in the stream during construction. After work is done, the padding is removed from the stream, and placed on the bank to assist in revegetation.

Clean, washed gravel
Clean, washed gravel can be placed on the stream bottom both during and after construction to minimize re-mobilizing the “fines”. Clean gravel or spawning gravel can often be specified to mitigate or enhance the existing substrate. Therefore, gravel “injection” can minimize TSS during construction while providing environmental and habitat enhancements with long-term benefits.

Excavation using a large bucket
Each time a bucket of soil is excavated or placed in the stream, a portion is of the soil is suspended. The resulting amount of sediment suspended increases proportionally to the number of scoops rather than the total of excavated soil. Therefore, using a large excavator bucket instead of a small one will reduce the total amount of soil that is suspended and available to wash downstream. Each time a bucket of soil is placed in the stream, a portion is suspended. Approximately the same amount is suspended whether a small amount of soil is placed in the stream, or a large amount.

Use of dozer for backfilling
Using a dozer for backfilling instead of a backhoe follows the same principles – the fewer times soil is deposited in the stream, the less soil will be suspended.

Partial dewatering with a pump
Partially dewatering a stream with a pump reduces the amount of water, and thus the amount of water that can suspend sediment.

How to know if you have high TSS:

Some commonly accepted standards for high TSS are:

- 50 mg/l or
- 10 mg/l above background TSS or,
- 10% above background TSS.

These standards are very stringent, and are very difficult to achieve in many situations. The background + 10 % (mg/l) is probably the most realistic and reasonable standard for protecting the aquatic resources, while allowing a restoration project to be implemented. Check with local ordinances for standards.

Inspection and Maintenance

- Inspect the stability and performance of all erosion and sediment control measures during construction.
- Monitor TSS levels before, during and after construction.

Construction Specifications

A stream diversion is a temporary bypass through a pipe, flume, or excavated channel that carries water flow around work areas. Stream diversion is commonly used during culvert installation or replacement. Where possible, a stream diversion should be the first choice to control erosion and sediment during the construction of culverts or other in-stream structures. During construction in a watercourse, particularly culvert installation and repair, these temporary water bypass structures are an effective sediment and erosion control technique. Check with local, state and federal regulatory authorities for permitting and design requirements.

Design Considerations

The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Advantages of a pumped diversion include:

- Downstream sediment transport can almost be eliminated
- De-watering of the work area is possible
- Pipes can be moved about to allow construction operations
- The dams can serve as temporary access.
- Increased flows can be managed by adding more pumping capacity.

Some disadvantages of a pumped diversion are:

- Flow volume is limited by pump capacity
- Requires 24-hour monitoring of pumps
- Sudden rain could overtop dams
- Minor in-stream disturbance to install and remove dams

Advantages of excavated channels and flumes are:

- Isolates work from water flow and allows dewatering
- Can handle larger flows than pumps

Disadvantages of excavated channels and flumes are:

- Bypass channel or flume must be sized to handle flows, including possible floods
- Channels must be protected from erosion
- Flow diversion and then re-direction with small dams causes in-stream disturbance and sediment

Stream diversions should not be used:

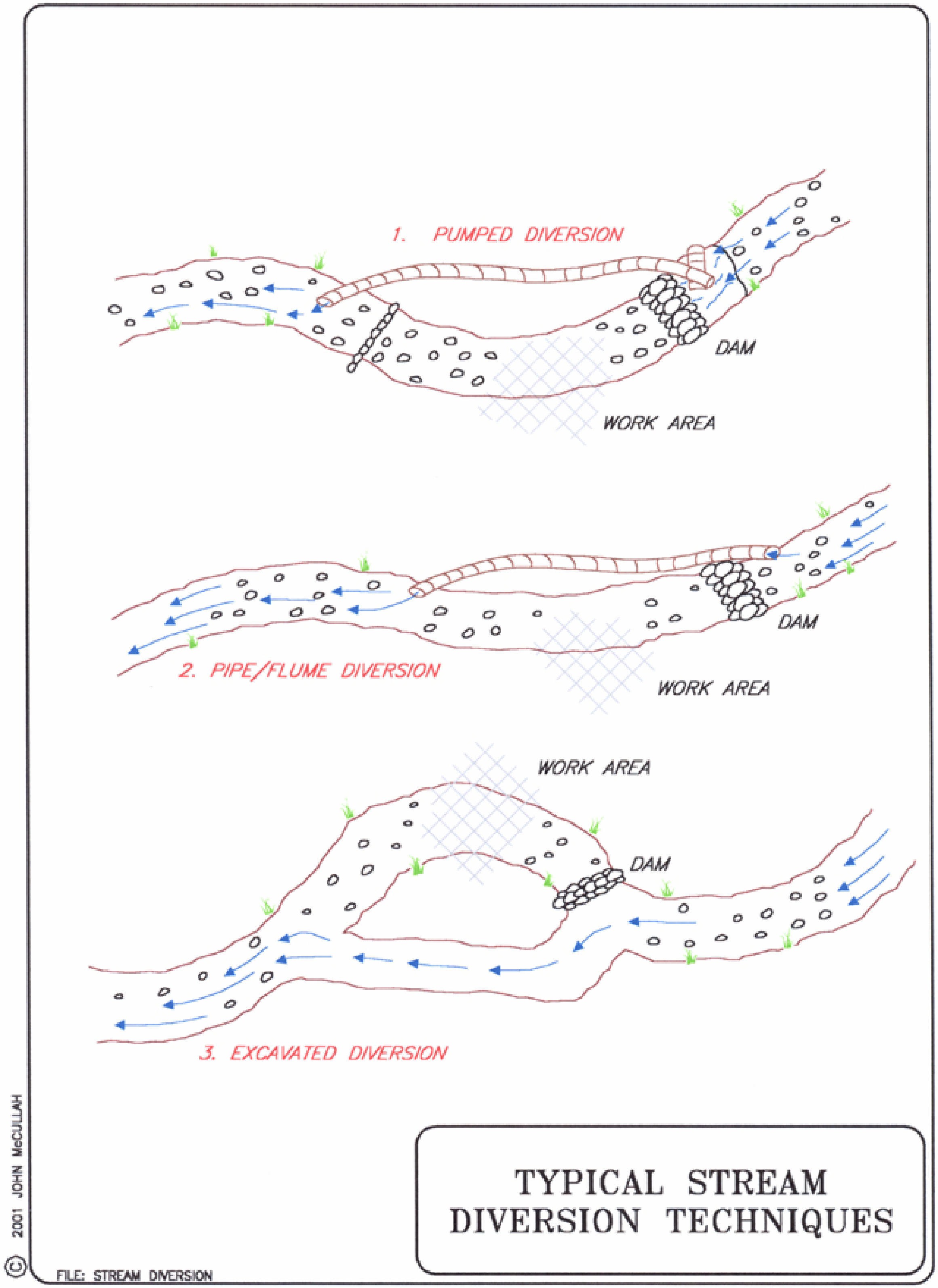
- Without identifying potential impacts to the stream channel
- In or adjacent to water bodies until all necessary permits have been obtained

Installation

- The pumped diversion is suitable for intermittent and low flow streams that can be pumped. Pump capacity must be sufficient for design flow. The upper limit is about 10ft^3/sec (0.28 m^3/sec), the capacity of two 8 inch (20 cm) pumps.
- A temporary dam is constructed upstream and downstream of the work area and water is pumped through the construction project in pipes. Dam materials should be selected to be erosion resistant, such as steel plate, sheetpile, sandbags, continuous berms, inflatable water bladders, etc.
- A temporary bypass channel can also be constructed by excavating a temporary channel or passing the flow through a heavy pipe (called a “flume”), and excavating a trench under it. Typical stream sizes are less than 20 ft (6 m) wide and less than 100 ft^3/sec (2.8 m^3/sec).

Inspection and Maintenance

- All stream diversions must be closely maintained and monitored
- Pumped diversions require 24-hour monitoring of pumps
- Upon completion of the work performed, the stream diversion should be removed and flow should be re-directed through the new culvert or back into the original stream channel.



Portable dams installed in Santa Cruz Ca. and in Alberta Canada.

Construction Specifications

An instream isolation technique is a temporary structure built into a waterway to enclose a construction area and reduce sediment pollution from construction work in or adjacent to water. The structures may be made of rock, sand bags, wood or water-filled geotextiles (aqua barriers). During construction in a watercourse, these structures are designed to reduce turbidity and sediment discharge, allowing contractors to follow clean water regulations.

Design Considerations

Isolation structures may be used in construction activities such as streambank stabilization, culvert installation, bridges, piers or abutments. It may be used in combination with other methods such as clean water bypasses and/or pumps.

This technique should not be used:

- If there is insufficient streamflow to support aquatic species.
- In deep water unless designed or reviewed by and engineer.
- To completely dam streamflows.

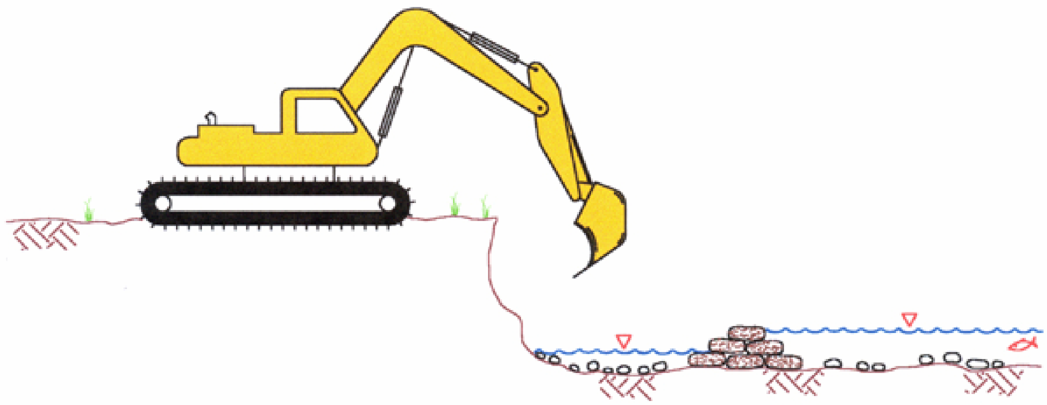
Installation

When used in watercourses or streams, cofferdams must be used in accordance with permit requirements. Materials for cofferdams should be selected based on ease of maintenance and complete removal following construction activities.

Inspection and Maintenance

- During construction, inspect daily.
- Schedule additional inspections during storm events.
- Immediately repair any gaps, holes or scour.
- Upon construction completion, the structure is removed.
- Remove sediment buildup.
- Remove structure. Recycle or re-use if applicable.
- Revegetate areas disturbed by cofferdam removal if applicable.

BENEFITS/LIMITATIONS
- *Difficult to dewater*
- *Inexpensive*
- *Labor intensive to install and remove*
- *Sand may be deposited in stream if bags break, better to use clean gravel*

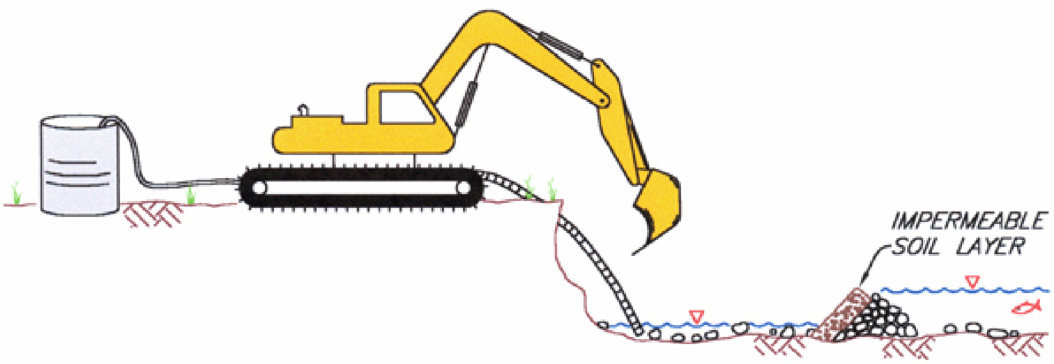


SAND BAG/GRAVEL BAG TECHNIQUE

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

FILE: INSTREAM TECHNIQUES3

BENEFITS/LIMITATIONS
- *Allows partial dewatering*
- *Relatively inexpensive*
- *Useful for small streams*
- *Minimal TSS when removed*



NOTES:

Step 1. Install clean gravel

Step 2. Place impermeable soil

Step 3. Do work

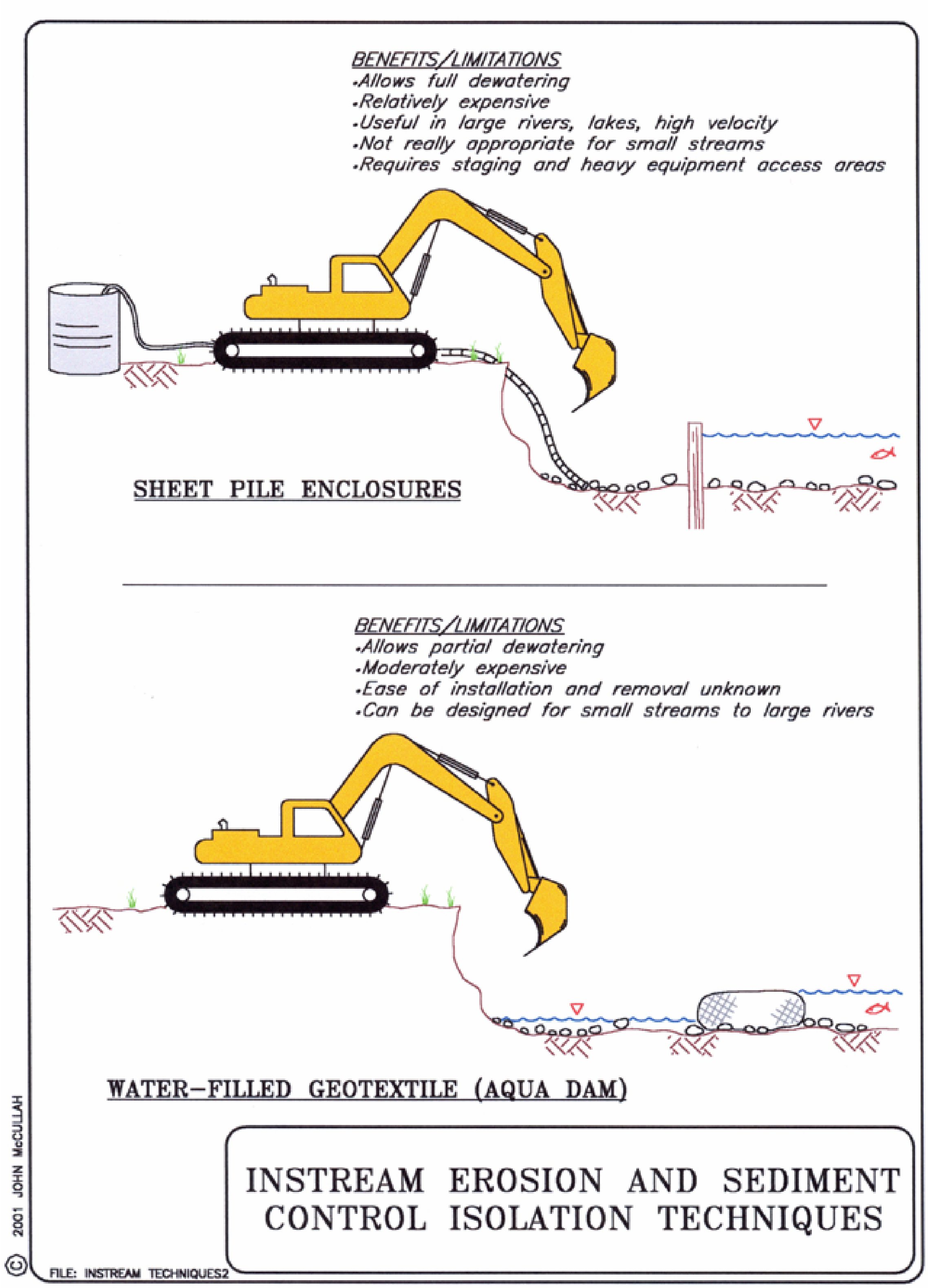
Step 4. Decommission berm by removing soil layer first

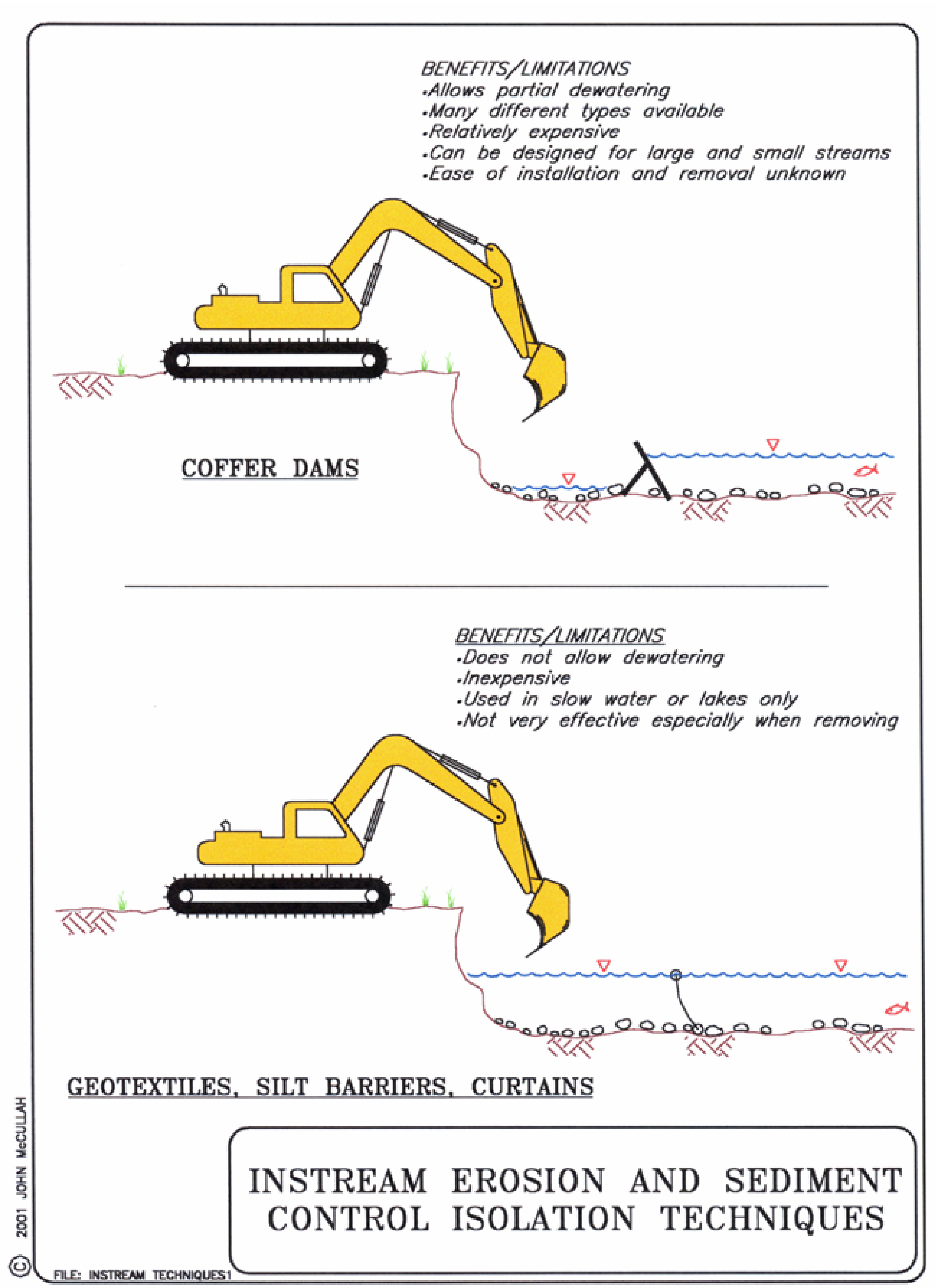
Step 5. Pump work area. Head differential will cause turbid water to flow into work area through gravel

Step 6. Remove or spread gravel

GRAVEL/SOIL BERM INSTREAM ISOLATION TECHNIQUE

FILE: BERM INSTREAM TECHNIQUES


BENEFITS/LIMITATIONS
•Allows full dewatering
•Relatively expensive
•Useful in large rivers, lakes, high velocity
•Not really appropriate for small streams
•Requires staging and heavy equipment access areas
SHEET PILE ENCLOSURES
BENEFITS/LIMITATIONS
•Allows partial dewatering
•Moderately expensive
•Ease of installation and removal unknown
•Can be designed for small streams to large rivers
WATER–FILLED GEOTEXTILE (AQUA DAM)
INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES
© 2001 JOHN McCULLAH
FILE: INSTREAM TECHNIQUES2



BENEFITS/LIMITATIONS
•Allows partial dewatering
•Many different types available
•Relatively expensive
•Can be designed for large and small streams
•Ease of installation and removal unknown
COFFER DAMS
BENEFITS/LIMITATIONS
•Does not allow dewatering
•Inexpensive
•Used in slow water or lakes only
•Not very effective especially when removing
GEOTEXTILES, SILT BARRIERS, CURTAINS
INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES
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FILE: INSTREAM TECHNIQUES1

APPENDIX E

EROSION PREVENTION BMPS

SCHEDULING – EP-1

Scheduling involves sequencing construction activities and the installation of erosion and sediment control measures to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff and vehicle tracking. The timing of soil-disturbing activities and the timing of implementation of BMPs are both critical to the prevention of accelerated erosion and transport of sediment off-site. The scheduling of grading should take into account the rainy season and should minimize the length of the time that soils are left exposed, and reduce the total area of exposed soil during the rainy season. Consideration should be given to phasing the grading and construction so that critical areas (such as highly erodible soils, areas adjacent to receiving waters, etc.) are not disturbed until the non-rainy season, and so the entire area that is disturbed at any one time is kept to a size that can be controlled effectively.

Construction Specifications:

- The optimum grading period is when the chance for precipitation is minimized (e.g., the non-rainy season), particularly for the critical areas. If precipitation is likely during grading, minimize the length of time that soils are exposed, and the total area of exposure.
- Materials used for erosion and sediment control shall be on site at all times.
- Take the following measures when precipitation is forecast:
    - Minimize the length of time that the soils are left exposed.
    - Reduce the total area of exposed soil.
    - Protect critical areas such as drainage channels, streams, and natural water courses.
    - Stabilize exposed areas quickly.
- The schedule shall clearly show how regional precipitation trends relate to soil-disturbing and re-stabilization activities. The construction schedule shall be incorporated into the Erosion and Sediment Control Plan.
- The schedule shall include detail on the implementation and deployment of temporary soil stabilization measures, temporary sediment controls, tracking controls, wind erosion controls, non-storm water pollution controls (including waste management and materials pollution controls).
- The schedule shall also include dates for significant long-term operations or activities that may have planned non-storm water discharges such as dewatering, saw cutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, bridge cleaning, etc.
- Develop the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, pouring foundations, installing utilities, etc., to minimize the active construction area during the rainy season.
- Schedule major grading operations when the chances of precipitation are minimized when practical.
- Schedule the installation, removal, or modification of run-on controls and flow conveyance structures for the non-rainy season or when there is a low probability of precipitation to reduce the likelihood of uncontrolled flow across and from the site.
- Stabilize non-active areas after the cessation of soil-disturbing activities or prior to the onset of precipitation in accordance with local requirements.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment controls and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year-round to deploy soil stabilization and sediment control practices. Erosion may be caused during dry seasons by unseasonable rainfall, wind, and vehicle tracking. Keep the site stabilized year-round, and retain and maintain sediment trapping devices in operational condition.
- Sequence trenching activities so that most open portions are closed before new trenching begins.
- Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
- Consider scheduling when establishing permanent vegetation (appropriate planting time for specified vegetation).

Inspection and Maintenance:

- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule to show updated information on the deployment and implementation of construction site BMPs.

PRESERVATION OF EXISTING VEGETATION / BUFFER STRIPS – EP-2

Maintaining existing vegetation or placing vegetative buffer strips can have numerous benefits for stormwater quality, erosion and sediment control, as well as landscape beautification, dust control, noise reduction, shade and watershed protection.

Construction Specifications:

Preservation of Existing Vegetation:

Timing

- Preservation of existing vegetation shall be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas identified on the plans to be preserved, especially on areas designated as Environmentally Sensitive Areas (ESAs) or where no construction activity is planned or will occur at a later date.
- Limits of clearing and grubbing should be clearly marked prior to any grading or clearing activities.
- Preservation of existing vegetation shall conform to scheduling requirements and local permitting agency requirements.

Design and Layout

- Mark areas to be preserved with temporary fencing made of orange polypropylene that is stabilized against ultraviolet light. The temporary fencing shall be at least 3.2. ft (1 meter) tall and shall have openings not larger than 2 in by 2 in (50 mm by 50 mm).
- Fence posts shall be either wood or metal as appropriate for the intended purpose. The post spacing and depth shall be adequate to completely support the fence in an upright position.
- Minimize the disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Construction materials, equipment storage, and parking areas shall be located where they will not cause root compaction.
- Keep equipment away from trees to prevent trunk and root damage at least to drip line.
- Maintain existing irrigation systems.
- Employees and subcontractors shall be instructed to honor protective devices. No heavy equipment, vehicular traffic, or storage piles of any construction materials shall be permitted within the drip line of any tree to be retained. Removed trees shall not be felled, pushed, or pulled into any retained trees. Fires shall not be permitted within 100 ft (30 m) of the drip line of any retained trees. No toxic or construction materials (including paint, acid, nails, gypsum board, chemicals, fuels, and lubricants) shall be stored within 50 ft (15 m) of the drip line of any retained trees, nor disposed of in any way which would injure vegetation.

Trenching and Tunneling

- Trenching shall be as far away from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching and/or tunneling near or under trees to be retained, tunnels shall be at least 18 in (450 mm) below the ground surface, and not below the tree center to minimize impact on the roots.
- Tree roots shall not be left exposed to air; they shall be covered with soil as soon as possible, protected, and kept moistened with wet burlap or peat moss until the tunnel and/or trench can be completed.

- The ends of damaged or cut roots shall be cut off smoothly.
- Trenches and tunnels shall be filled as soon as possible or in accordance with local requirements. Careful filling and tamping will eliminate air spaces in the soil which can damage roots.
- Remove any trees intended for retention if those trees are damaged seriously enough to affect their survival.
- After all other work is complete, fences and barriers shall be removed last. This is because protected trees may be destroyed by carelessness during the final cleanup and landscaping.

Vegetative Buffer Strips:

- Vegetated buffer strips (vegetated filter strips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and allowing sediment and other pollutants (e.g., total and dissolved metals) to settle and partially infiltrate into underlying soils. With proper design and maintenance, filter strips can provide relatively high pollutant removal.
- Designate watercourse buffer-filter strips on the site design plan.
- The width of a buffer strip (i.e., flow path length) shall be maximized to the extent feasible with a 15 foot suggested minimum width. Buffer strips shall be sized in accordance with site conditions and local requirements.

TOPSOILING – EP-4

Topsoiling is the practice of stripping and stockpiling existing topsoil and then spreading it in graded areas to encourage future vegetation growth.

Construction Specifications:

Planning:

- Determine whether the quality and quantity of available topsoil justifies selective handling and in consideration of local requirements.
- Soils of the textural class of loam, sandy loam, and silt loam are best; sandy clay loam, silty clay loam, clay loam, and loamy sand are fair. Do not use heavy clay and organic soils such as peat or muck as topsoil.

Stripping and Stockpiling:

- Strip topsoil only from those areas that will be disturbed by excavation, filling, or compacting by equipment. A 4-6 inch (0.1-0.2 m) stripping depth is common, but depth varies depending on the site.
- Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Topsoil depth generally varies along a gradient from hilltop to toe of the slope.
- Put sediment basins, diversions, and other controls into place before stripping.
- Select stockpile location to avoid slopes, natural drainage ways, and traffic routes. On large sites, re-spreading is easier and more economical when topsoil is stockpiled in small piles located near areas where they will be used.
- Use sediment fences or other barriers where necessary to retain sediment.
- Protect topsoil stockpiles by temporarily seeding and/or mulching as soon as possible to assure the stored material is not unnecessarily exposed and allowed to erode. Use locally grown and native seed stocks when possible that are mycorrhizal-dependent.
- Topsoil stockpiles should be low n height (ideally <1 meter) and flat and be used within 6 months to promote healthy soil organisms and microbes. Stockpiles not used within 6 months should be reseeded with a species that is mycorrhizal-dependent to avoid the development of anaerobic conditions in the stockpile. In addition, topsoil stockpiles can be turned periodically to keep organisms alive for larger stockpiles and during extremely hot weather.

Spreading:

- Before spreading topsoil, establish erosion and sediment control practices such as diversions, berms, dikes, waterways, and sediment basins.
- Where the pH of the existing subsoil is 6.0 or less, or the soil is composed of heavy clays, incorporate agricultural limestone in amounts recommended by soil tests or specified for the seeding mixture to be used. Incorporate lime to a depth of at least 2 inches (51 mm) by disking. Ensure that all of the lime mixture is incorporated into the soil to minimize direct contact with storm water runoff and handle lime in accordance with manufacturing recommendations or NS-7 (Materials Delivery and Storage).
- Immediately prior to spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least 3 inches (76 mm), to ensure bonding of the topsoil and subsoil. If no amendments have been incorporated, loosen the soil to a depth of at least 6 inches (0.15 m) before spreading topsoil.
- Uniformly distribute topsoil to a minimum compacted depth of 2 inches (51 mm) on 3:1 slopes and 4 inches (0.1 m) on flatter slopes.
- Do not spread topsoil while it is frozen or muddy or when the subgrade is wet or frozen.
- Correct any irregularities in the surface that result from topsoiling or other operations to prevent the formation of depressions or water pockets.
- Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compacting, as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where high maintenance turf is to be established.

Temporary seeding and planting consists of the establishment of temporary vegetative cover on disturbed areas to reduce erosion by seeding with appropriate and rapidly growing annual grasses and forbs.

Construction Specifications

Conditions Where Practice Applies

- Cleared or graded areas that are exposed and subject to erosion for extended periods (e.g., 14 to 30 days depending on local requirements).
- Cleared or graded areas exposed to seasonal rains.
- Areas that will not be subjected to heavy wear by construction equipment.
- Temporary seeding is encouraged whenever possible to aid in reducing erosion on construction sites. Temporary seeding is an important component of "phased" construction activities. Permanent seeding shall be applied to areas intended to be left dormant for a year or more.

The following chart shows recorded shear stress and velocities withstood by grass mixtures and applications.

Bank Material/Protection	**Shear**		**Velocity**			**Reference**
	lb/ft^2	**N/m^2**	**ft/s**	**m/s**		
Sandy Loam	0.0167		1.75	0.53	Design	Temple, 1980
Silt Loam	0.0218		2	0.61	Design	Temple, 1980
Alluvial silts	0.0218		2	0.61	Design	Temple, 1980
Ordinary firm loam	0.0341		2.5	0.76	Design	Temple, 1980
Very light loose sand, no vegetation or protection			1-1.5	.3-.46	Limit	Fortier & Scobey, 1926
Average sandy soil			2-2.5	.61-.76	Limit	Fortier & Scobey, 1926
Stiff clay, ordinary gravel soil			4-5	1.2-1.5	Limit	Fortier & Scobey, 1926
Bermuda grass, erosion resistant soils, 0-5% slope			8	2.4	Design	USDA, 1947
Bermuda grass, erosion resistant soils, 5-19% slope			7	2.1	Design	USDA, 1947
Bermuda grass, erosion resistant soils, over 10% slope			6	1.8	Design	USDA, 1947
Bermuda grass, easily eroded soils, 0-5% slope			6	1.8	Design	USDA, 1947
Bermuda grass, easily eroded soils, 5-10% slope			5	1.5	Design	USDA, 1947
Bermuda grass, easily eroded soils, over 10% slope			4	1.2	Design	USDA, 1947
Grass mixture, erosion resistant soils, 0-5% slope			5	1.5	Design	USDA, 1947
Grass mixture, erosion resistant soils, 5-10% slope			4	1.2	Design	USDA, 1947
Grass mixture, easily eroded soils, 0-5% slope			4	1.2	Design	USDA, 1947
Grass mixture, easily eroded soils, 5-10% slope			3	0.91	Design	USDA, 1947

1” riprap	0.33	16			Limit	Chen & Cotton, 1988
2” riprap	0.67	33			Limit	Chen & Cotton, 1988
6” riprap	2	98			Limit	Chen & Cotton, 1988
12” riprap	4	196			Limit	Chen & Cotton, 1988
Dense sod, fair condition (class D/E), moderately cohesive soil	0.35	17			Limit	Austin & Theisen, 1994
Bermuda grass, fair stand <12 cm tall, dormant	0.9	44			Limit	Parsons, 1963
Bermuda grass, good stand <12 cm tall, dormant	1.1	54			Limit	Parsons, 1963
Bermuda grass, excellent stand 20 cm tall, dormant	2.7	132			Limit	Parsons, 1963
Bermuda grass, excellent stand 20 cm tall, green	2.8	137			Limit	Parsons, 1963
Bermuda grass, excellent stand >20 cm tall, green	3.2	156			Limit	Parsons, 1963
12.5 cm of excellent growth of grass/woody veg on outside bend	1	49			Limit	Parsons, 1963
Flume trials, fabric reinforced vegetation – failed after 50 hours	5	244			Limit	Theisen, 1992
Flume trials, fabric reinforced vegetation – failed after 8 hours	8	391			Limit	Theisen, 1992
Sod revetment, short period of attack	0.41	20.09			Design	Schoklitsch, 1937
Wattle (coarse sand between)	0.2	9.8			Design	Schoklitsch, 1937
Wattles (gravel between)	0.31	15.19			Design	Schoklitsch, 1937
Wattles (parallel or oblique to current)	1	49			Design	Schoklitsch, 1937
Fascine revetment	1.4	68.6			Design	Schoklitsch, 1937
Cribs with stone	30	1470			Design	Schoklitsch, 1937
Turf (immediately after construction)	0.2	10			Limit	Schiechtl & Stern, 1994
Turf (after 3-4 seasons)	2.04	100			Limit	Schiechtl & Stern, 1994

Site Considerations

- Prior to seeding, install necessary erosion control practices such as temporary continuous berms, diversion dikes, channels, and sediment basins.
- Proper seedbed preparation and the use of quality seed are important in this practice just as in permanent seeding. Failure to carefully follow sound agronomic recommendations will often result in an inadequate stand of vegetation that provides little or no erosion control.
- Annual plants which sprout rapidly and survive for only one growing season are suitable for establishing temporary vegetative cover. Consider mixes because they are more adaptable than single species.
- Check with local municipalities for local specifications and requirements prior to seeding and planting.

- Mulching is commonly used with seeding practices for temporary cover and to aid in the establishment of vegetation.
- Temporary seeding also prevents costly maintenance operations on other erosion control systems. For example, sediment basin maintenance (clean-out) will be reduced if the drainage area has temporary vegetative cover when grading and construction are not taking place. (Temporary seeding is essential to preserve the integrity of earthen structures used to control sediment, such as diversion dikes, and sediment basins)
- To reduce the amount of fertilizer, pesticides and other inputs needed, choose adapted varieties based on environmental conditions, management level desired, and the intended use. Check with local municipalities prior to use of fertilizer or pesticides.

Timing

The proper time to seed is dependent upon the climate of the area and the species of seed selected. To determine seeding dates for temporary cover, consult the seed supplier.

Seed Mixes

- All seed should be selected in accordance with local municipality requirements.
- Select plants appropriate to the season and site conditions**.**
- The seeding rates are based on a minimum acceptable pure live seed (PLS) of 80%. When PLS is below 80% adjust rates accordingly.
- Legumes should be inoculated with the proper rhizobium bacteria before planting. Pellet inoculated seed can be purchased or inoculation can be done in the field. Use only fresh, age dated inoculate specifically labeled for use with the legume you are using.

Site Preparation

- Grade as needed and feasible to permit the use of equipment for seedbed preparation.
- Install needed erosion control practices, such as sediment basins, diversion dikes and channels, prior to seeding. Divert concentrated flows away from seeded areas.
- Soil tests should be done to determine the nutrient and pH content of soil. Depending on the results of soil tests, soil management may be necessary to adjust the pH to between 6.5 and 7.0 (for most conditions). All lime, fertilizer and other soil amendments should be added following sound soil management practices.
- Surface roughening: If the area has been recently loosened or disturbed, no further roughening is required. When the area is compacted, crusted or hardened the soil should be loosened with discing, raking or harrowing. Tracking with bulldozer cleats is very effective on sandy soils.
- Hydroseeding and hydraulic planting generally require less seedbed preparation.
- Generally, slopes steeper than 2:1 that cannot have good seedbed preparations with equipment will require hydraulic planting techniques.
- Seed to soil contact is the key to good germination. Prepare a 3-5 inch (76-127 mm) deep seedbed, with the top 3-4 inches (76-102 mm) consisting of topsoil. Note that the earth bed upon which the topsoil is to be placed should be at the required grade.
- The seedbed should be firm but not compact. The top 3 inches (76 mm) of soil should be loose, moist and free of large clods and stones. For most applications, all stones larger than 2 inches (51 mm) in diameter, roots, litter and any foreign matter should be raked and removed. The topsoil surface should be in reasonably close conformity to the lines, grades and cross sections shown on the grading plans.

Hydroseeding site in September 2003

December 2003

April 2004

Planting:

- Seed should be applied as soon after seedbed preparation as possible, when the soil is loose and moist.
- Always apply seed before mulch, unless seed is applied with a hydraulic matrix or bonded fiber matrix (See BMP EP-8, Mulches).
- Apply seed at the rates specified using calibrated spreaders, cyclone seeders, mechanical drills, or hydroseeders so the seed is applied uniformly on the site.
- If seed is applied with a bonded fiber matrix, apply BFM from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage, and failure of the BFM.
- Apply fertilizer if required. Seed and fertilizer should be incorporated into the soil by raking or chain dragging, or otherwise floated, then lightly compacted to provide good seed-soil contact.
- Straw mulch, erosion control blankets or mulch and tackifiers/soil binders should be applied over the seeded areas.

***Inspection and Maintenance*:**

- Newly seeded areas need to be inspected frequently to ensure the grass is growing. Areas that fail to establish cover adequate to prevent sheet and rill erosion will be reseeded as soon as such areas are identified. Spot seeding can be done on small areas to fill in bare spots where grass did not grow properly.
- If the seeded area is damaged due to concentrated runoff, additional practices may be needed.
- Temporary vegetated areas will be maintained until permanent vegetation or other erosion control practices can be established.

PERMANENT SEEDING AND PLANTING EP-6

Permanent seeding involves the establishment of a permanent, perennial vegetative cover on disturbed areas from seed. Refer to BMP EP-21 for installation of sod. Planting of shrubs, trees, and container plants should be conducted in accordance with project landscaping specifications and local requirements.

The use of native, indigenous, or naturally-occurring grasses is recommended for biotechnical works. These “native” grasses have evolved in a manner that will not compete with or preclude the establishment, or natural recruitment, of naturally-occurring woody vegetation. Establishment of permanent vegetation provides natural erosion and sediment control by trapping particulates, slowing runoff velocities and enhancing infiltration. Permanent vegetation also is beneficial for long-term aesthetics and wildlife habitat.

Construction Specifications

Conditions Where Practice Applies

- Graded, final-graded or cleared areas where permanent vegetative cover is needed to stabilize the soil. Permanent seeding with perennial grasses is recommended when fibrous and deeply rooted are needed to provide slope and soil reinforcement.
- Slopes designated to be treated with erosion control blankets should be seeded first.
- Grass-lined channels or waterways designed to be treated with turf reinforcement mats, fiber roving systems, or other channel liners will require special grass blends.

Materials

Proper seed selection is very important. Choose climatically adapted perennial species that are long-lived, hearty and require low inputs of fertilizer, irrigation and mowing. You may consider a locally occurring species for native grass establishment. Consider seed blends because they are more adaptable.

Use seeds appropriate to the season and site conditions. Use a seed blend, which include annuals, perennials and legumes. Legumes should be inoculated with the proper rhizobium bacteria before planting. Pellet inoculated seed can be purchased or inoculation can be done in the field. Unless otherwise specified by local requirements, use seed rates based on minimum pure live seed (PLS) of 80%. When PLS is below 80% adjust rates accordingly. Consult a local seed supplier, landscape architect, or erosion control specialist for appropriate seed blends. Seed should be selected in accordance with local regulations.

Installation

The probability of successful plant establishment can be maximized through good planning, knowledge of soil characteristics, selection of appropriate seed blends for the site, good seedbed preparation, and timely planting. Prior to seeding, install necessary erosion control practices such as diversion dikes, channels, and sediment basins. Site area should be at final grade and not be disturbed by future construction activities.

Timing

- Apply permanent seeding on areas left dormant for 1 year or more.
- Apply permanent seeding when no further disturbances are planned.
- To determine optimum seeding schedule, consult a local agronomist or erosion control specialist.
- Apply permanent seeding before seasonal rains or freezing weather is anticipated.
- Use dormant seeding for late fall or winter seeding schedules.

Seed Mixes

- Use seeds appropriate to the season and site conditions.
- Consult local agronomist or erosion control specialists for seed mix.
- Use a seed blend to include annuals, perennials and legumes.

- Use seed rates based on pure live seed (PLS) of 80%. When PLS is below 80% adjust rates accordingly.

Site Preparation

- Bring the planting area to final grade and install the necessary erosion control BMPs (i.e., sediment basins and temporary diversion dikes).
- Divert concentrated flows away from the seeded area.
- Conduct soil test to determine pH and nutrient content. Roughen the soil by harrowing, tracking, grooving or furrowing.
- Apply amendments as needed and permitted by local municipalities to adjust pH to 6.0-7.5. Incorporate these amendments into the soil. Prepare a 3-5 in (76-127 mm) deep seedbed, with the top 3-4 in (76-102 mm) consisting of topsoil. The seedbed should be firm but not compact. The top three inches of soil should be loose, moist and free of large clods and stones. The topsoil surface should be in reasonably close conformity to the lines, grades and cross sections shown on the grading plans.

Planting:

- Seed to soil contact is the key to good germination.
- Seed should be applied immediately after seedbed preparation while the soil is loose and moist. If the seedbed has been idle long enough for the soil to become compact, the topsoil should be harrowed with a disk, spring tooth drag, spike tooth drag, or other equipment designed to conditions the soil for seeding.
- Harrowing, tracking or furrowing should be done horizontally across the face of the slope.
- Always apply seed before applying mulch, unless using a hydraulic matrix or bonded fiber matrix where seed is mixed with mulch prior before application.
- Apply seed at the rates specified using calibrated seed spreaders, cyclone seeders, mechanical drills, or a hydroseeder so the seed is applied uniformly on the site.
- Broadcast seed should be incorporated into the soil by raking or chain dragging, and then lightly compacted to provide good seed-soil contact.
- Apply fertilizer as specified and allowed by local municipalities.
- Apply mulch or erosion control blanket, as specified, over the seeded areas.

Inspection and Maintenance

- Newly seeded areas need to be inspected frequently to ensure the grass is growing.
- If the seeded area is damaged due to runoff, additional stormwater measures may be needed.
- Spot seeding can be done on small areas to fill in bare spots where grass did not grow properly.
- Irrigation/watering should be used as necessary and recommended to establish vegetation in accordance with local regulations.

MULCHES – EP-8

Mulching is the process of applying bulk materials to the soil surface to reduce rainfall impact, increase infiltration and in some cases, aid in revegetation. Common types of mulch include vegetable fibers, green material, hydraulic mulches from recycled paper or wood fibers, hydraulic matrices, and straw mulch. Mulches may include a tackifier to increase the longevity of the application.

Construction Specifications:

- Mulch should be used for temporary applications only; permanent erosion control measures should also be applied.
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
- Avoid mulch over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

Wood Fiber Mulch – Materials and Application Procedures

- Wood fiber mulch is a component of hydraulic applications. It is usually used in combination with seed and fertilizer. It is typically applied at the rate of 2,000 to 4,000 lb/ac (2,250 to 4,500 kg/ha) with 0-5% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer) and applied as a slurry. This type of mulch is manufactured from wood or wood waste from lumber mills or from urban sources.
- Wood fiber mulch can be specified with or without a tackifier; previous work has shown that wood fiber mulches with tackifiers have better erosion control performances.
- Materials for wood fiber based hydraulic mulches and hydraulic matrices shall conform to Oregon DOT Standard Specifications Sections 01030.15 and 01030.16 and local municipality requirements and specifications.

Recycled Paper Mulch – Materials and Application Procedures

- Recycled paper mulch contains fibers of shorter length than wood fiber mulches and is typically made from recycled newsprint, magazine, or other waste paper sources. It is a component of hydraulic applications and is usually used in combination with seed and fertilizer. It is typically applied at the rate of 1 to 2 tons/ac (2,250 to 4,500 kg/Ha). It can be specified with or without a tackifier.

Green Material – Materials and Application Procedures

- This type of mulch is produced by recycling vegetation trimmings such as grass, shredded shrubs and trees. Methods of application are generally by hand, although pneumatic methods are available. Mulch shall be composted to kill weed seeds.
- It may be used as a temporary ground cover with or without seeding.
- The green material shall be evenly distributed on site to a depth of not more than 2 in (50 mm).

Hydraulic Matrix – Materials and Application Procedures

- Hydraulic matrix is a combination of wood fiber mulch and a tackifier applied as a slurry. It is typically applied at the rate of 2,000 to 4,000 lb/ac (2,250 to 4,500 kg/ha) with 5-10% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer).
- Materials for wood fiber based hydraulic mulches and hydraulic matrices shall conform to Oregon DOT Standard Specifications Sections 01030.15 and 01030.16 and local municipality requirements and specifications.
- Hydraulic matrices require 24 hours to dry before rainfall occurs to be effective unless approved by Oregon DEQ.

Bonded Fiber Matrix – Materials and Application Procedures

- Bonded fiber matrix (BFM) is a hydraulically-applied system of fibers and adhesives that upon drying forms an erosion-resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,000 to 4,000 lb/ac (3,400 to 4,500 kg/ha) based on the manufacturer's recommendation. The biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM shall also be biodegradable and shall not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs require 12 to 24 hours to dry to become effective.
- BFM should be selected and used in accordance with local municipality requirements and specifications.
- Apply bonded fiber matrices from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage, and failure of the BFM.

Straw Mulch - Materials

- All materials shall conform to Oregon DOT Standard Specifications Sections 01030.15(b) and any local municipality requirements.
- Straw shall be derived from wheat, rice, or barley. The straw mulch contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw obtained from outside the county in which it is to be used is delivered to the site of the work. Straw that has been used for stable bedding shall not be used.

Straw Mulch – Application Procedures

- Apply loose straw at a minimum rate of 4,000 lb/ac (3,570 kg/ha), or as indicated in the project's Erosion and Sediment Control Plan, either by machine or by hand distribution.
- The straw mulch must be evenly distributed on the soil surface.
- Avoid placing straw onto the traveled way, sidewalks, lined drainage channels, walls, and existing vegetation.
- Anchor the mulch in place by using a tackifier (preferred) or by "punching" it into the soil mechanically (incorporating).
- If using a tackifier to anchor the straw mulch in lieu of incorporation, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.
- A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place (see Oregon DOT Standard Specifications Section 01030.16).
- A tackifier is typically applied at a rate of 125 lb/ac (140 kg/ha). In windy conditions, the rate is typically 178 lb/ac (200 kg/ha).
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity. If the selected method is incorporation of straw mulch into the soil, then do as follows:
    - Applying and incorporating straw shall follow the requirements in Oregon DOT Standard Specifications Section 01030.48(b) and any local municipality's specifications and requirements.
    - On small areas, a spade or shovel can be used.
    - On slopes with soils, which are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw may be "punched" into the ground using a knife-blade roller or a straight bladed coulter, known commercially as a "crimper."
    - On small areas and/or steep slopes, straw may also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes. Refer to EP-10, "Erosion Control Blankets and Mats."

Inspection and Maintenance:

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked. Inspect before expected rain events and repair any damaged ground cover and re-mulch exposed areas of bare soil.
- The key consideration in maintenance and inspection is that the mulch needs to last long enough to achieve erosion control objectives. Mulch is a temporary ground cover and not suitable for long-term erosion control.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are non-active. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of mulch and tackifier may be required by Oregon DEQ and local municipalities to maintain effective soil stabilization over disturbed areas and slopes.
- After any rainfall event, maintain all slopes to reduce or prevent erosion.

APPENDIX F

SEDIMENT CONTROL BMPS

SEDIMENT FENCE – SC-1

Construction Specifications:

Local municipality requirements should be checked to determine if local requirements differ from this BMP with respect to specific types of sediment fence allowed and methods of installation.

<u>Prefabricated Sediment Fence</u>

Prefabricated fence fabric shall consist of material approved by its manufacturer for use in sediment fence applications and shall include pre-fabricated pockets for stake installation. Select standard duty or heavy duty prefabricated sediment fence based on criteria shown below:

Standard Duty Sediment Fence

- Slope of area draining to fence is 4H:1V or less - Use is generally limited to less than five months
- Area draining to fence produces moderate sediment loads
- Use prefabricated standard duty sediment fence.
- Layout in accordance with typical layout - Install in accordance with attached detail.

Heavy Duty Sediment Fence

- Slope of area draining to fence is 1H:1V or less
- Use generally limited to eight months. Longer periods may require fabric replacement
- Area draining to fence produces moderate sediment loads
- Use prefabricated heavy duty sediment fence. Heavy duty sediment fences typically have the following physical characteristics:
    - Fence fabric has greater tensile strength than other fabric types available from manufacturer
    - Fence fabric has a greater permittivity than other fabric types available from manufacturer
    - Fence fabric may be reinforced with a backing or additional support to increase fabric strength
    - Posts may be spaced closer together than other pre- manufactured sediment fence types available from manufacturer.
- Layout in accordance with attached typical layout.
- Install in accordance with attached standard details.

Installation

- Install sediment fence along a level contour, with the last 6 ft of fence turned up slope. Except for the ends, the difference in elevation between the highest and lowest point along the top of the sediment fence shall not exceed one-third the fence height.
- Generally, should be used in conjunction with erosion source controls up slope to provide effective control.

Minimum BMP standards that apply to Prefabricated Sediment Fence are provided on the attached details.

Common Reasons/Circumstances for Failure

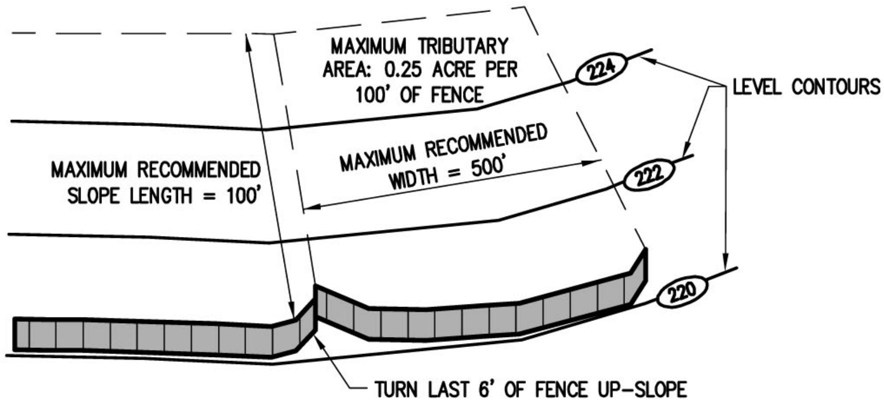
- The most common reasons for sediment fence failure are due to improper installation and poor maintenance. In particular, the toe must be securely trenched into the slope and accumulated sediment should be removed when accumulation reaches 1/3 of the fence height.

Inspection and Maintenance:

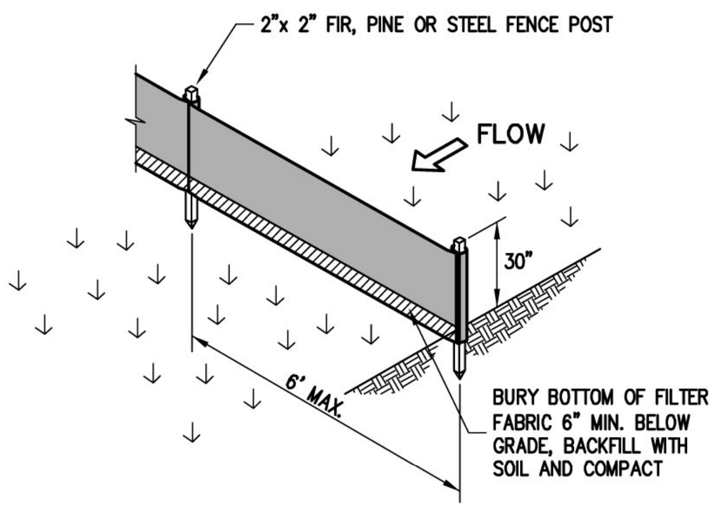
- Repair undercut sediment fences.

- Repair or replace split, torn, slumping, or weathered fabric.
- Inspect sediment fence before, during, and after storm events.
- Any required repairs shall be performed as soon as possible.
- Remove sediment when accumulation reaches 1/3rd the fence height.
- The removed sediment shall be incorporated in the project, disposed of properly, or appropriately stabilized with vegetation.
- Remove sediment fence when no longer needed and upslope area has been stabilized. Fill and compact post holes and anchorage trench, remove sediment accumulation, and grade fence alignment to blend with adjacent ground.

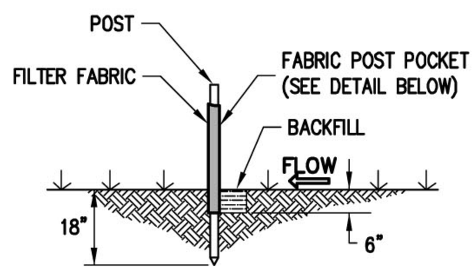
SEDIMENT FENCE – SC-1



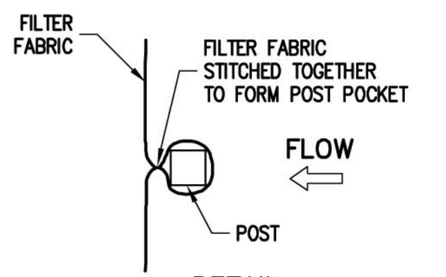
TYPICAL PREFABRICATED SEDIMENT FENCE LAYOUT



TYPICAL PREFABRICATED SEDIMENT FENCE LAYOUT



SECTION
MINIMUM INSTALLATION



DETAIL
FABRIC POST POCKET

NOTES:

1.) INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY.

2.) REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

3.) SEDIMENT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.

4.) STITCHED POCKETS TO BE INSTALLED ON UPHILL SIDE OF SLOPE.

Construction Specifications

A compost filter berm is a trapezoidal berm applied by a blower and a compost sock is compost material encased in mesh to form a tube/roll. Both techniques intercept sheet flow and pond runoff, allowing sediment to fall out of suspension, and often filtering sediment as well. Compost berms and socks provide an environmentally-sensitive and cost-effective alternative to sediment fence.

Advantages

- Compost berms and compost socks made from biodegradable mesh sometimes offer a better solution than sediment fence and other sediment control methods, because compost does not require any special trenching, construction, or removal, unlike straw bales, sediment fence or coir rolls. This makes the technique very cost-effective.
- Compost is organic, biodegradable, renewable, and can be left onsite. This is particularly important below embankments near streams, as re-entry to remove or maintain the berm can cause additional disturbance. Sediment fence has to be disposed of in landfills and is often left abandoned on jobsites.
- Compost does not leach nutrients. Field tests in Connecticut have shown that run-off from compost treated sites has very low soluble salts, and all metals and nutrients are well within pollution leaching limits.
- Compost berms can be easily and quickly fixed should something happen to them in the course of construction. Compost socks withstand heavy machinery, but frequent disturbance can decrease the effectiveness of the sock.
- Mechanical compost spreaders for compost berms are commercially available and are widely used in the Pacific Northwest.
- When properly made, compost is full of nutrients and micro-organisms that stimulate turf and increase resistance to diseases. Compost binds heavy metals and can break down hydrocarbons into carbon, salts and other innocuous compounds.

Design Considerations

Compost filter berms and socks should be used at the base of slopes 2:1 or less. There are many types of compost, all with different properties, so it is best to determine what application the compost is being used for. For compost berms and socks, compost should have the following specifications:

- Compost needs to be stable and mature.
- Particle size: Compost should consist of both large and small pieces for maximum filtration. Finer grades (screened through 3/8-1/2") are better for vegetation establishment, long term plant nutrients, and increased infiltration rates. The coarser grades (screened 2-3") are better for increased filtration, and are less likely to be disturbed by rainfall and runoff. For berms, the ratio of coarse and fine material should be 1:1. No particle should be greater than 3".
- The recommended moisture content ranges from 20-50%. Compost that is too dry is harder to apply, while that which is too wet is heavier and harder to transport. In drier areas, use compost with a higher moisture content; in wet areas, use the drier compost, as it will absorb water.
- Organic matter content: The percentage of carbon based materials in finished compost should range between 40-70%. However, Texas DOT specifies no less than 70%.
- The pH should be between 5.0 and 8.5.
- Nitrogen Content: 0.5-2.0%.
- Compost should have a minimum of soluble salts, as these can inhibit vegetation establishment. These levels should be between 4.0 and 6.0 mmhos/cm.
- Compost must be weed and pesticide free, with manmade materials comprising less than 1%.

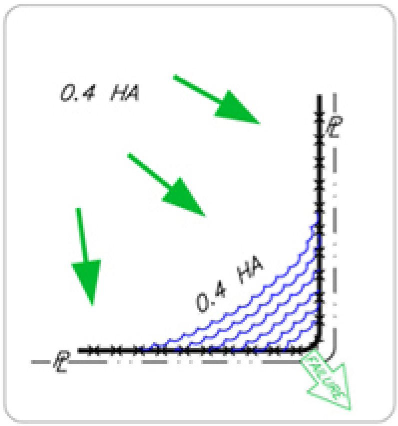
Construction Specifications

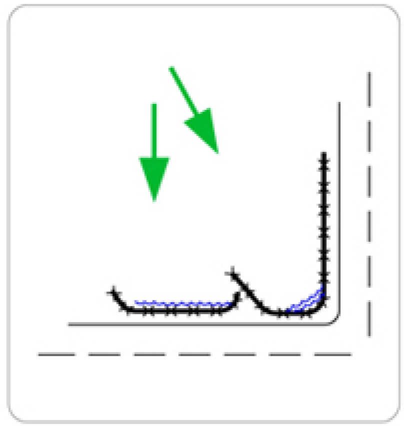
- For compost berms on slopes of 3:1 or less, install a compost berm 1-2 ft high and 2-4 ft wide at the base. For maximum filtration properties, install berm in a trapezoidal shape, with a 4-6 ft base, and a 2-3 ft wide top. Larger berms should be used for steeper slopes. The basic rule of thumb is that the base should be twice the height of the berm.
- Typically, compost socks can handle the same water flow or slightly more than sediment fence. However, the installation technique is especially important for them to work effectively. For most applications, standard sediment fence is replaced with 12" compost socks.
  - When placed on level contours sheet flow of water should be perpendicular to the compost sock at impact and un-concentrated.
  - Place compost socks at a 5' or greater distance away from the toe of slopes to maximize space available for sediment deposition.
  - In order to prevent water flowing around the ends of compost socks, point the ends upslope to place them at a higher elevation.

- Compost Berms and Socks can be placed around the perimeter of affected areas, if the area is flat or the perimeter is on contour. Berms and socks should be placed using ‘smiles’ and j-hooks. Do not place berms and socks where they cannot pond water.
- For steeper slopes, an additional berm or sock can be constructed on the top of the slope.
- Compost berms and socks can be seeded during application. However, field tests indicate that it is best to have only a thin layer of compost over the seed in compost berms. Slopes seeded with 2- 4” of compost over the seed had less vegetation establishment than slopes with less compost over the seed.
- Do not use compost berms and socks in areas of concentrated flow, as they are intended to control and filter sheet flow only.
- Tackifiers may be applied to berms if needed to enhance performance.

Inspection and Maintenance

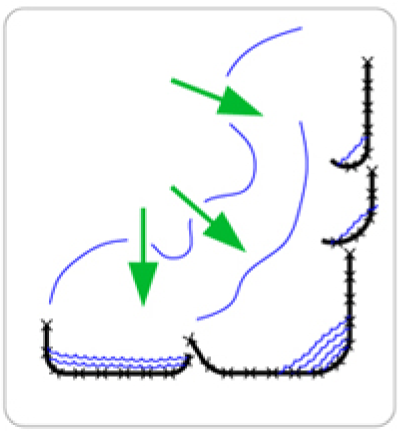
- Compost berms and socks shall be inspected after each storm event and reapplied if necessary.
- Sediment retained by the berm or sock shall be removed when it has reached 1/3 of the exposed height of the berm. Alternatively, the sediment and berm or sock can be stabilized with vegetation at the end of construction.
- Berms can be left onsite and seeded, or spread out in place as a soil enhancement.

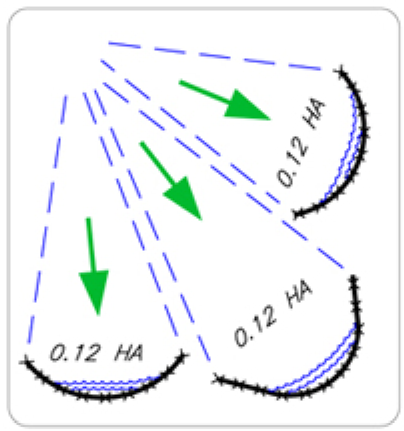




Incorrect – Do Not layout "perimeter control" compost berms along property lines. All sediment laden runoff will concentrate and overwhelm the system.

Correct – Install J–hooks

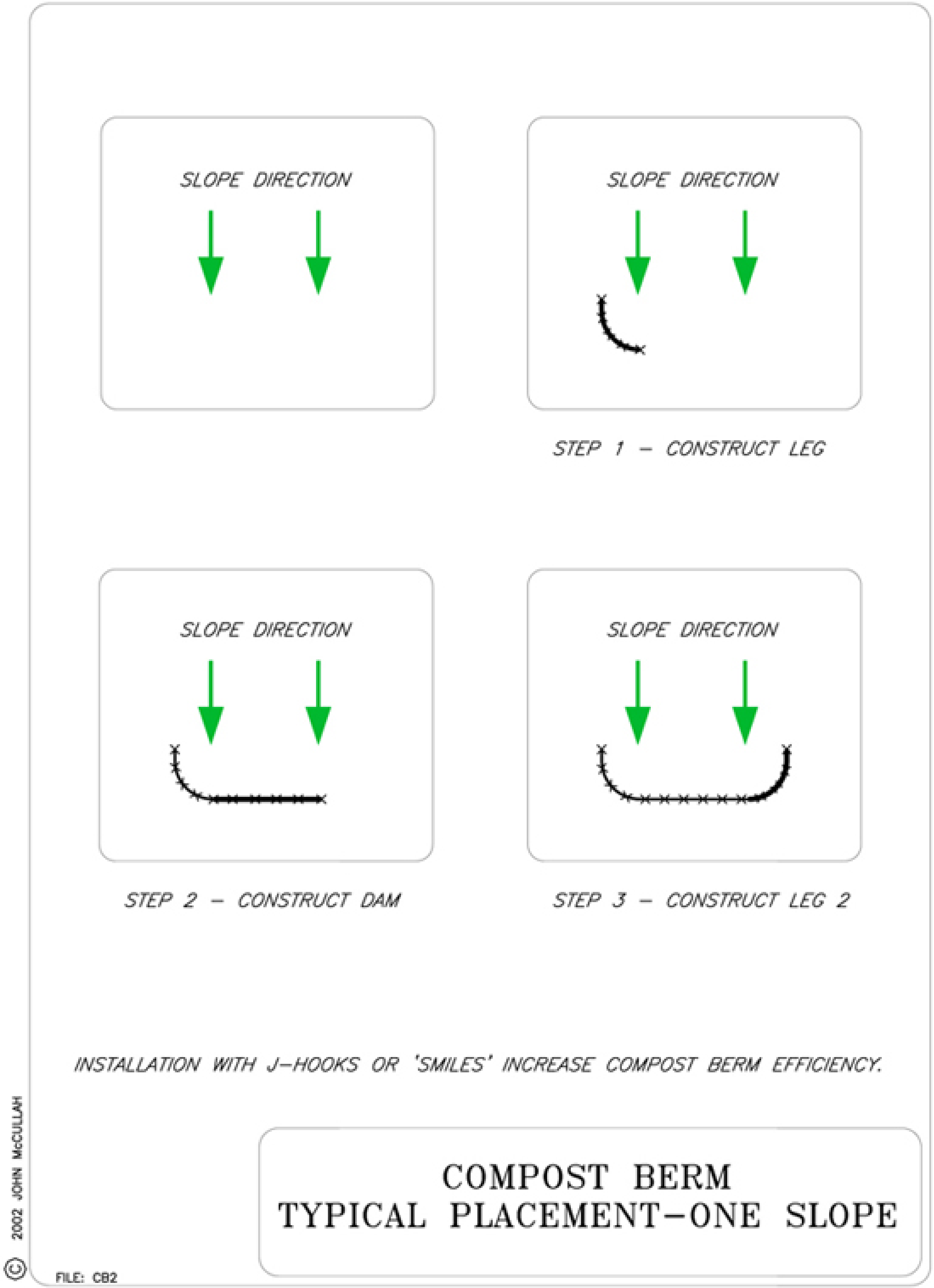


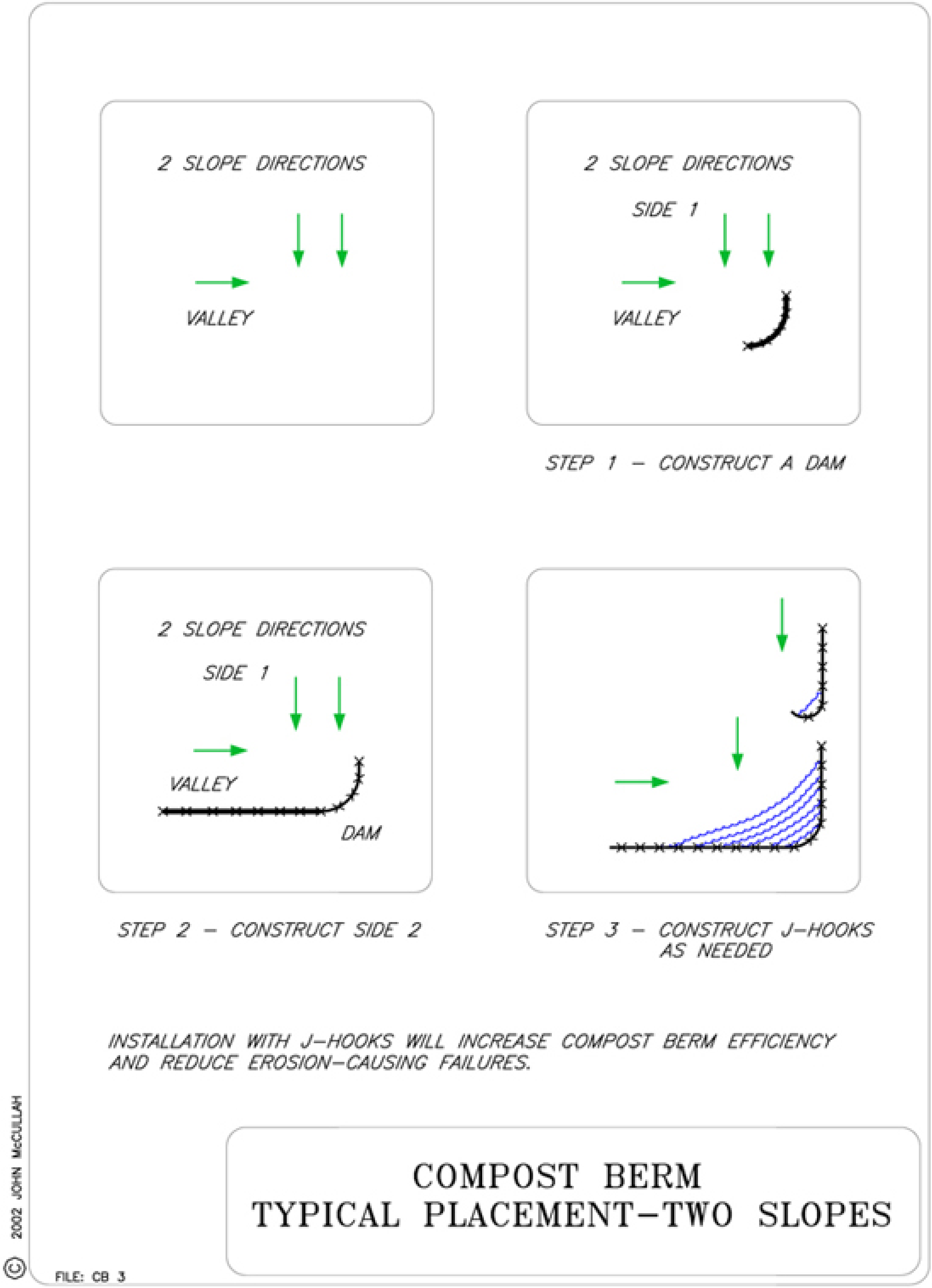


Discreet segments of compost berms, installed with J–hooks or 'smiles' will be much more effective.

COMPOST BERM PLACEMENT FOR PERIMETER CONTROL

FILE: CB 1


SLOPE DIRECTION
SLOPE DIRECTION
STEP 1 – CONSTRUCT LEG
SLOPE DIRECTION
SLOPE DIRECTION
STEP 2 – CONSTRUCT DAM
STEP 3 – CONSTRUCT LEG 2
INSTALLATION WITH J–HOOKS OR 'SMILES' INCREASE COMPOST BERM EFFICIENCY.
COMPOST BERM
TYPICAL PLACEMENT–ONE SLOPE
© 2002 JOHN McCULLAH
FILE: CB2


2 SLOPE DIRECTIONS
VALLEY
2 SLOPE DIRECTIONS
SIDE 1
VALLEY
STEP 1 – CONSTRUCT A DAM
2 SLOPE DIRECTIONS
SIDE 1
VALLEY
DAM
STEP 2 – CONSTRUCT SIDE 2
STEP 3 – CONSTRUCT J–HOOKS AS NEEDED
INSTALLATION WITH J–HOOKS WILL INCREASE COMPOST BERM EFFICIENCY AND REDUCE EROSION–CAUSING FAILURES.
COMPOST BERM
TYPICAL PLACEMENT–TWO SLOPES
© 2002 JOHN McCULLAH
FILE: CB 3

Construction Specifications

Fiber rolls are manufactured from biodegradable fibers (such as weed-free rice straw) that are wrapped in photo degradable netting. They range from approximately 8 to 20 inches in diameter by 25-30 feet (8-9 m) long. Rolls are placed and staked along the contour of newly constructed or disturbed slopes, in shallow trenches. Fiber rolls reduce slope length, and are intended to capture and keep sediment on the slopes. Fiber rolls are useful to temporarily stabilize slopes by reducing soil creep, and sheet and rill erosion until permanent vegetation can be established. Fiber rolls can catch soil that is moved down the slope by the freeze/thaw processes. Organic matter and seeds are trapped behind the rolls, which provide a stable medium for germination. Rolls trap topsoil and retain moisture from rainfall, which aids in growth of seedlings planted upslope of the rolls.

Design Considerations:

- Sites appropriate for fiber rolls are:
  - Slopes susceptible to sheet and rill erosion.
  - Slopes producing dry ravel.
  - Slopes susceptible to freeze/thaw activity.
  - Slopes difficult to vegetate because of soil movement.
- Fiber rolls are not intended for use in concentrated flow situations.
- It is imperative, especially on steeper slopes, that a sufficiently deep trench is constructed in which to place the roll. Without the trench, the roll will not function properly, runoff will scour underneath it, and trees or shrubs planted behind the roll will not have a stable environment in which to become established.
- Fiber rolls last an average of two years, depending on the fiber and mesh used in manufacturing. This is an important factor to consider when planning how long the slope will need to be mechanically stabilized.
- Fiber rolls can be staked with live stakes if site conditions warrant. The moisture retained by the fiber roll will encourage cutting establishment.

Advantages

- Fiber rolls are a relatively low-cost solution to sheet and rill erosion problems.
- They can replace sediment fences or straw bales on steep slopes.
- Rolls are a short-term solution to help establish native vegetation.
- Rolls store moisture for vegetation planted immediately upslope.
- Plastic netting will eventually photo-degrade, eliminating the need for retrieval of materials after the fiber or straw has broken down.

- The fibers become incorporated into the soil with time, adding organic material to the soil and retaining moisture for vegetation.

Disadvantages

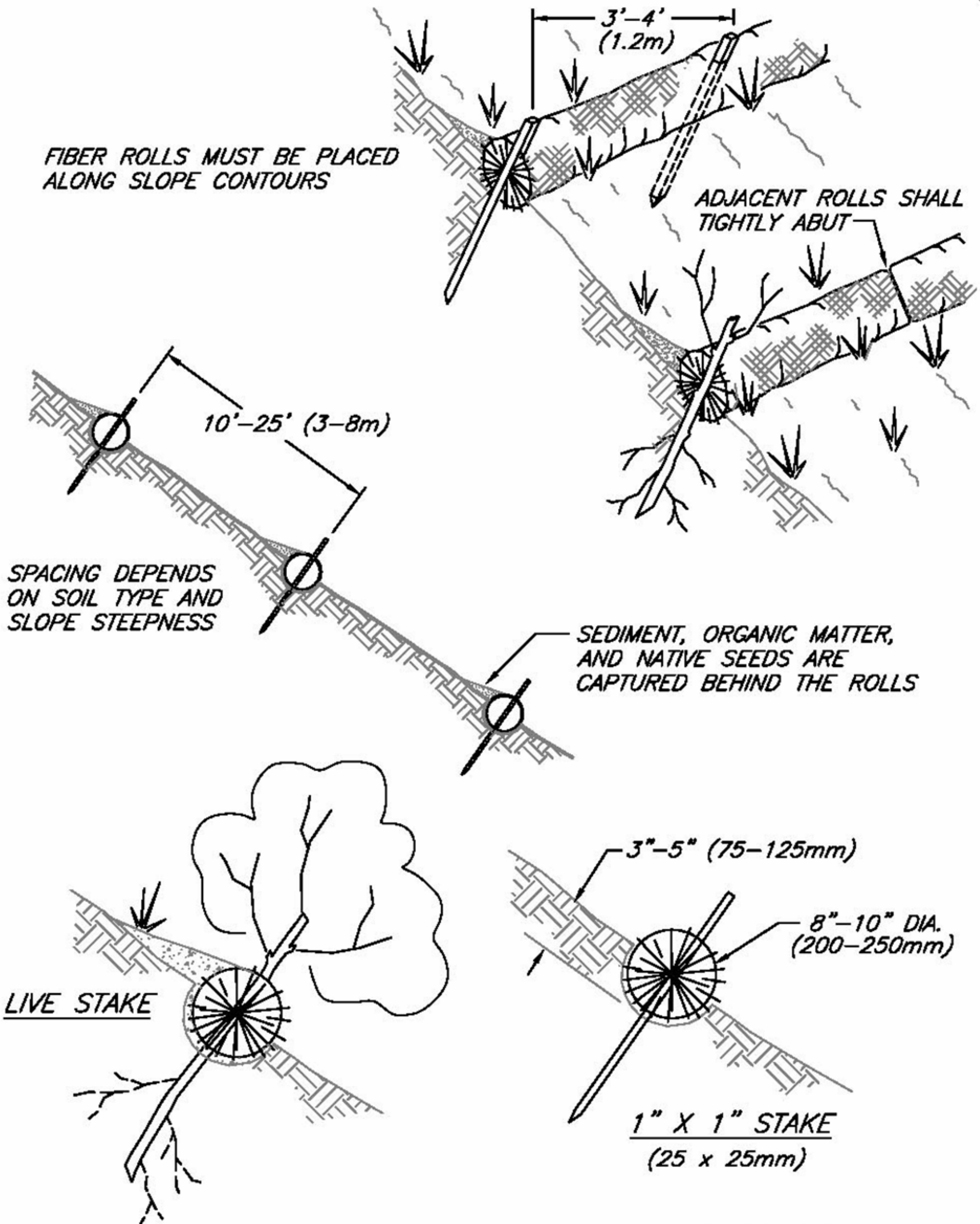
- Rolls only function for one or two seasons.
- Pilot holes through the rolls must be pre-driven with a metal rod.
- If not installed properly with a sufficient trench, rolls may fail during the first rain event.
- Fiber rolls may require maintenance to ensure that the stakes are holding and the rolls are still in contact with the soil. This is especially true on steep slopes in sandy soil.

Installation

- Prepare the slope before the installation procedure is started.
- Shallow gullies should be smoothed as work progresses.
- Dig small trenches across the slope on contour, to place rolls in. The trench should be deep enough to accommodate half the thickness of the roll. When the soil is loose and uncompacted, the trench should be deep enough to bury the roll 1/3 of its thickness because the ground will settle.
- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- Construct trenches at contour intervals 25-30 feet (8-10 m) apart depending on the steepness of the slope. The steeper the slope, the closer together the trenches should be.
- Lay the roll along the trenches fitting it snugly against the soil. Make sure no gaps exist between the soil and the straw wattle.
- Use a straight bar to drive holes through the roll and into the soil for the willow or wooden stakes.
- Drive the stake through the prepared hole, and into the soil. Leave only 1 or 2 inches (25 or 51 mm) of the stake exposed above roll.
- Install stakes at least every 4 feet (1.2 m) apart along the length of the wattle. Additional stakes may be driven on the downslope side of the trenches on highly erosive or very steep slopes.

Inspection and Maintenance

- Inspect the rolls and the slopes after rain events and at the frequencies required by local municipalities. Make sure the rolls are in contact with the soil.
- Repair any rills or gullies promptly.
- Reseed or replant vegetation if necessary until the slope is stabilized.



NOT TO SCALE

NOTE:

1. FIBER ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3"–5" (75–125mm) DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

FIBER ROLLS

FILE: STRWROLL

Construction Specifications:

A sediment basin is a temporary basin with a controlled release structure, formed by excavating or constructing an earthen embankment across a waterway or low drainage area. Sediment basins may be placed where sediment laden storm water may enter a storm drain or watercourse, and around and/or up-slope from storm drain inlet protection measures. The sediment basin shall follow one of the four design options summarized below:

1. A sediment basin designed pursuant to local ordinance provided that the design efficiency is as protective, or more protective of water quality than Option No. 3.
2. A sediment basin designed with a minimum capacity of 3,600 cubic feet of storage per acre of disturbed land in a watershed equivalent to or more efficient than Option No. 3.
3. A sediment basin designed using the following equation:

   $(V) = 1.2Q/Vs_{ED}$ where:

   V = settling zone volume,

   Q = flow rate based on peak discharge from a specified design storm (where Q = CiA; see Section 2.4), and

   Vs_{ED} = settling velocity of the design soil particle.
4. A basin designed using an equivalent surface area design equation, equivalent to or more efficient than Option No. 3.

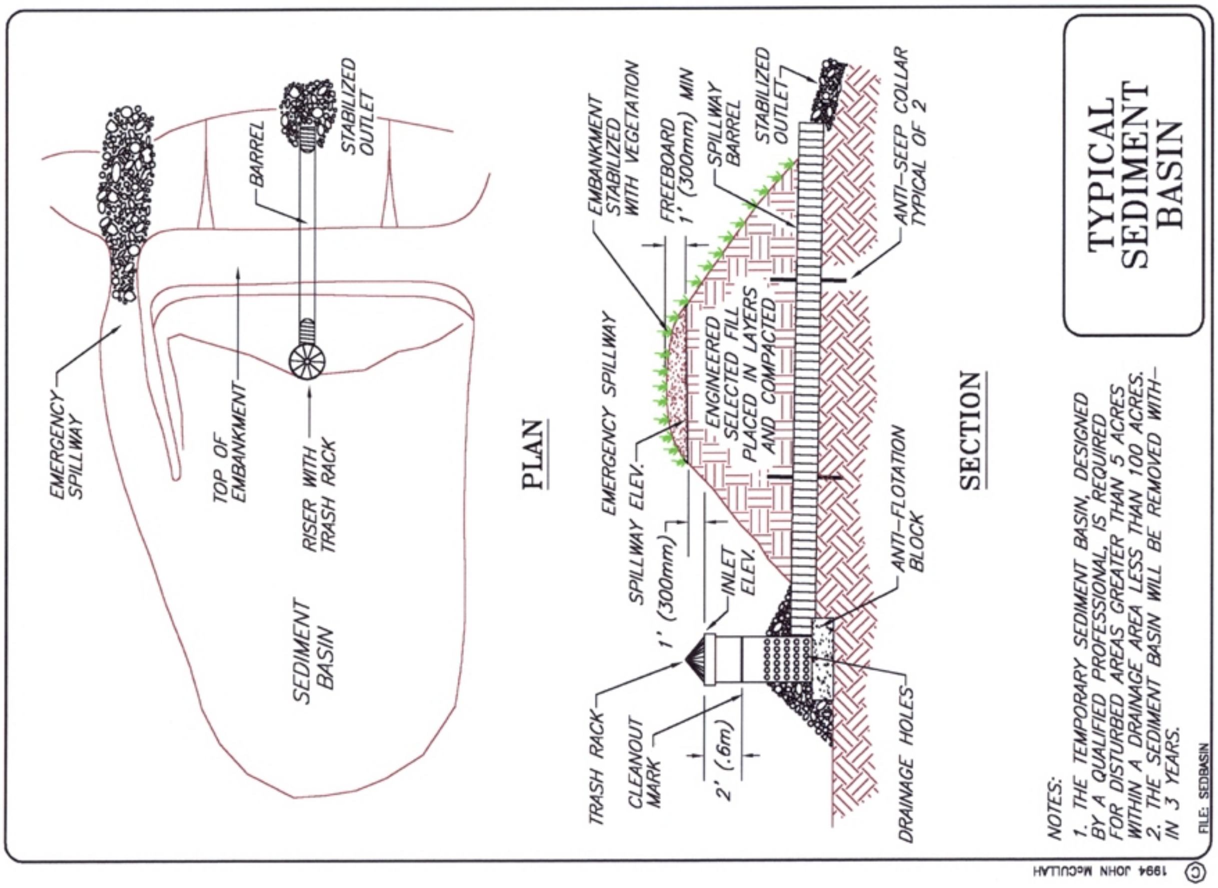
- In accordance with the requirements of the NPDES 1200-C General Permit, all sediment basins must be designed by a professional engineer licensed in Oregon.
- Construct the basin by excavating or building an embankment before any clearing or grading work begins.
- Areas under the embankment and any structural works shall be cleared, grubbed and stripped of any vegetation and rootmat as shown on the grading plan.
- In order to facilitate cleanout and restoration, the basin area shall be cleared, grubbed and stripped of any vegetation.
- A cut-off trench shall be excavated along the centerline of the earth fill embankments. The minimum depth shall be 2 feet (0.6 m). The cut-off trench shall extend up both abutments to the spillway elevation.
- Fill material for the embankment shall be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material, and sufficiently moist for compaction.
- Fill material shall be placed in 6 inch (0.2 m) lifts, continuous layers over the entire length of the fill. Compaction shall be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment, or by the use of a compactor.
- The embankment should be constructed to an elevation of 10 percent higher than the design height to allow for settlement if compacting is achieved with hauling equipment. If compactors are used for compacting, the overbuild may be reduced to not less than 5 percent. The basin shall have means for dewatering within 7 days following a storm event.
- The principal spillway riser shall be securely attached to the discharge pipe by welding all around. All connections shall be watertight. A trash rack shall be installed on the top of the riser to prevent clogging of the discharge pipe.

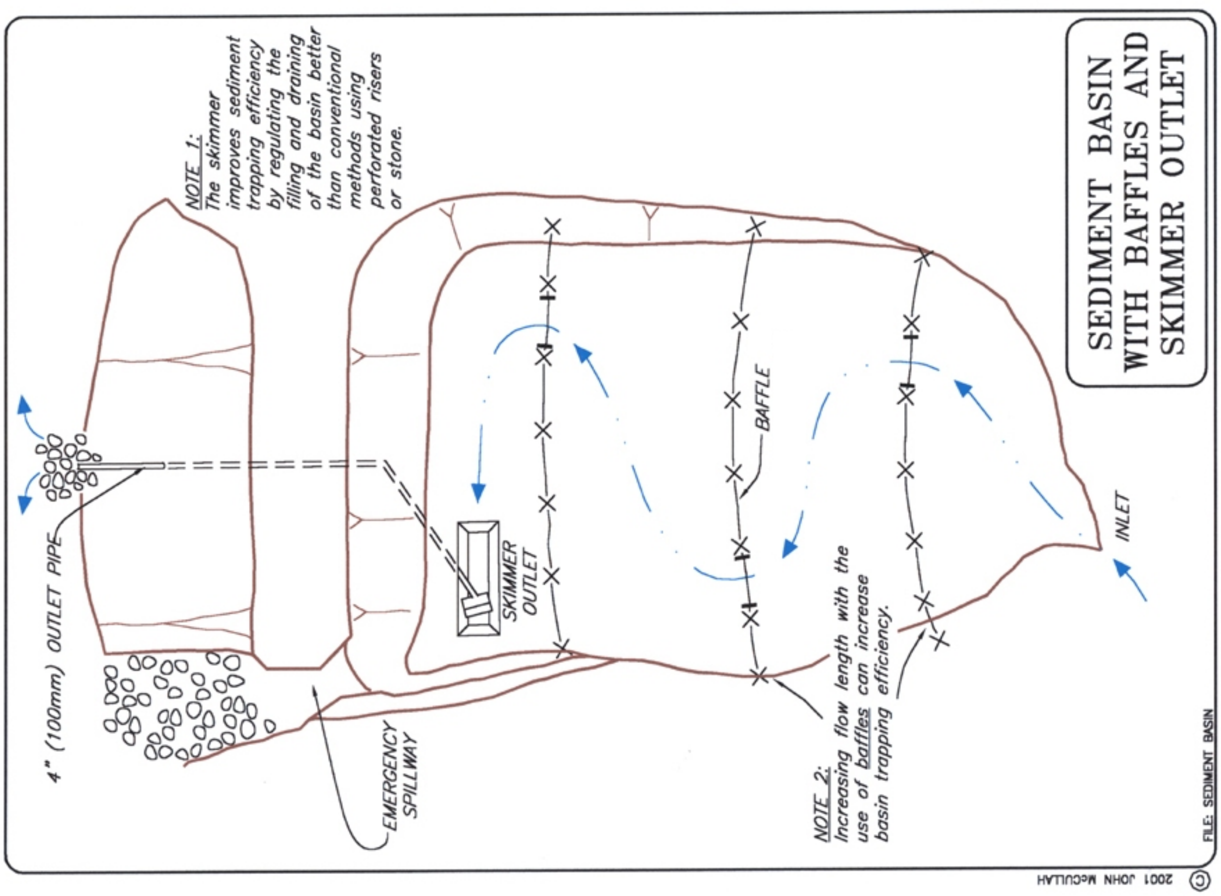
- The pipe and riser shall be placed on a firm, smooth soil foundation. The connection between the riser and the riser base shall be watertight. Pervious materials such as sand, gravel or crushed stone shall not be used as backfill around the pipe or anti-seep collars.
- The fill material around the pipe spillway shall be placed in 4-inch (101 mm) layers and compacted under the shoulders and around the pipe to at least the same density as the adjacent embankment. A minimum of 2 feet (0.6 m) of compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment.
- Steel base plates shall have at least 2 1/2 feet (0.8 m) of compacted earth, stone or gravel over them to prevent flotation.
- The emergency spillway shall not be installed in fill. Elevations, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway.
- If used, baffles shall be constructed of 4 inch (101 mm) by 4 inch (101 mm) posts and of 4 foot (1.2 m) by 8 foot (2.4 m) - 1/2inch (12.7 mm) exterior plywood. The posts shall be set at least 3 feet (0.9 m) into the ground, no further apart than 8 feet (2.4 m) center to center, and shall reach a height 6 inches (0.2 m) below the riser crest elevation. Alternatively, earthen berms, metal sheeting, or other methods may be used as approved by DEQ or the local agency in the project ESCP.
- The embankment and emergency spillway shall be stabilized with vegetation immediately following construction. The outflow shall be provided with outlet protection to prevent erosion and scour of the embankment and channel.
- Construction operations shall be carried out in such a manner that erosion and water pollution will be minimized.
- Local and state requirements shall be met concerning fencing and signs warning the public of hazards of soft sediment and floodwater.

Minimum BMP standards are provided on the following details.

Inspection and Maintenance:

- Inspect before during, and after each rain event.
- All damages caused by soil erosion or construction equipment shall be repaired before the end of each working day.
- Remove sediment when the sediment storage zone is half full. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.
- When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit shall be leveled or otherwise disposed of in accordance with the approved erosion and sediment control plan.


TYPICAL SEDIMENT BASIN
PLAN
EMERGENCY SPILLWAY
TOP OF EMBANKMENT
RISER WITH TRASH RACK
SEDIMENT BASIN
BARREL
STABILIZED OUTLET
SECTION
TRASH RACK
CLEANOUT MARK
2' (.6m)
1' (300mm)
SPILLWAY ELEV.
INLET ELEV.
EMERGENCY SPILLWAY
EMBANKMENT STABILIZED WITH VEGETATION
FREEBOARD 1' (300mm) MIN
SPILLWAY BARREL
STABILIZED OUTLET
ENGINEERED SELECTED FILL PLACED IN LAYERS AND COMPACTED
DRAINAGE HOLES
ANTI-FLOTATION BLOCK
ANTI-SEEP COLLAR TYPICAL OF 2
NOTES:
1. THE TEMPORARY SEDIMENT BASIN, DESIGNED BY A QUALIFIED PROFESSIONAL, IS REQUIRED FOR DISTURBED AREAS GREATER THAN 5 ACRES WITHIN A DRAINAGE AREA LESS THAN 100 ACRES.
2. THE SEDIMENT BASIN WILL BE REMOVED WITHIN 3 YEARS.
FILE: SEDBASIN
© 1994 JOHN McCULLAH


SEDIMENT BASIN WITH BAFFLES AND SKIMMER OUTLET
NOTE 1: The skimmer improves sediment trapping efficiency by regulating the filling and draining of the basin better than conventional methods using perforated risers or stone.
4" (100mm) OUTLET PIPE
EMERGENCY SPILLWAY
SKIMMER OUTLET
BAFFLE
INLET
NOTE 2: Increasing flow length with the use of baffles can increase basin trapping efficiency.
FILE: SEDIMENT BASIN
© 2001 JOHN McCULLAH

ENTRANCE / EXIT TRACKING CONTROLS – SC-10

Tracking controls reduce offsite tracking of sediment and other pollutants by providing a stabilized entrance at defined construction site entrances and exits and/or providing methods to clean-up sediment or other materials to prevent them from entering a storm drain by sweeping or vacuuming.

Construction Specifications:

- Stabilize entrances should be implemented on a project-by-project basis in addition to other BMPs.
- Sweeping or vacuuming should be implemented when sediment is tracked from the project site onto public or private paved roads, typically at points of site exit.
- Use stabilized entrances and/or sweeping at construction sites:
  - Where dirt or mud is tracked onto public roads;
  - Adjacent to water bodies;
  - Where poor soils are encountered, such as soils containing clay;
  - Where dust is a problem during dry weather conditions.

Stabilized Construction Entrances

- Limit the points of entrance/exit to the construction site by designating combination or single purpose entrances and exits. Require all employees, subcontractors and others to use them. Limit speed of vehicles to control dust. Clearly mark entrances and exits with appropriate signage.
- Locate construction entrances and exits to limit sediment leaving the site and to provide for maximum utility by all construction vehicles. Avoid entrances which have steep grades and entrances at curves in public roads.
- Grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions.
- Use of constructed or constructed/manufactured steel plates with ribs (e.g., shaker / rumble plates or corrugated steel plates) for entrance/exit access is allowable (See below).
- The aggregate size for construction of the pad shall be 3-6 inch (76-152 mm) stone. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
- The thickness of the pad shall not be less than 8 inches (203 mm). Use geotextile fabric, if necessary, to improve stability of the foundation in locations subject to seepage or high water table.
- The width of the pad shall not be less than the full width of all points of ingress or egress and in any case shall not be less than 12 feet (3.6 m) wide.
- The length of the pad is as required, but not less than 50 feet (15.2 m).
- All sediment spilled, dropped, washed or tracked onto public rights-of-way shall be removed as soon as possible by hand sweeping or mechanized sweeper. Washing of sediment from the public right-of-way shall be prohibited.
- Provide drainage to carry water to a sediment trap or other suitable outlet.
- When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way (see SC-11, Entrance / Exit Tire Wash).
- All sediment shall be reduced or prevented from entering any storm drain, ditch or watercourse through use of sediment fence, gravel bags, sediment barriers, or other approved methods.

Minimum BMP standards are provided on the following detail.

Entrance with Shaker Plates

- Incorporate with a stabilized construction entrance/exit.
- Construct on level ground when possible, on a pad of coarse aggregate, greater than 3 inches (76 mm) and smaller than 6 inches (150 mm). A geotextile fabric shall be placed below the aggregate.
- Install constructed or manufactured steel plates with ribs (e.g., rumble plates or corrugated steel plates) at the entrance/exit in addition to the aggregate.
- Steel shaker plates shall be designed and constructed/manufactured for anticipated traffic loads.

Street Sweeping and Vacuum Sweeping

- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed as needed. Manual sweeping is appropriate for small jobs.
- For larger projects, it is preferred to use mechanical broom or vacuum sweepers that collect and contain removed sediment and material.

If not mixed with debris or trash, incorporate the removed sediment back into the project or depose of it at an approved disposal site.

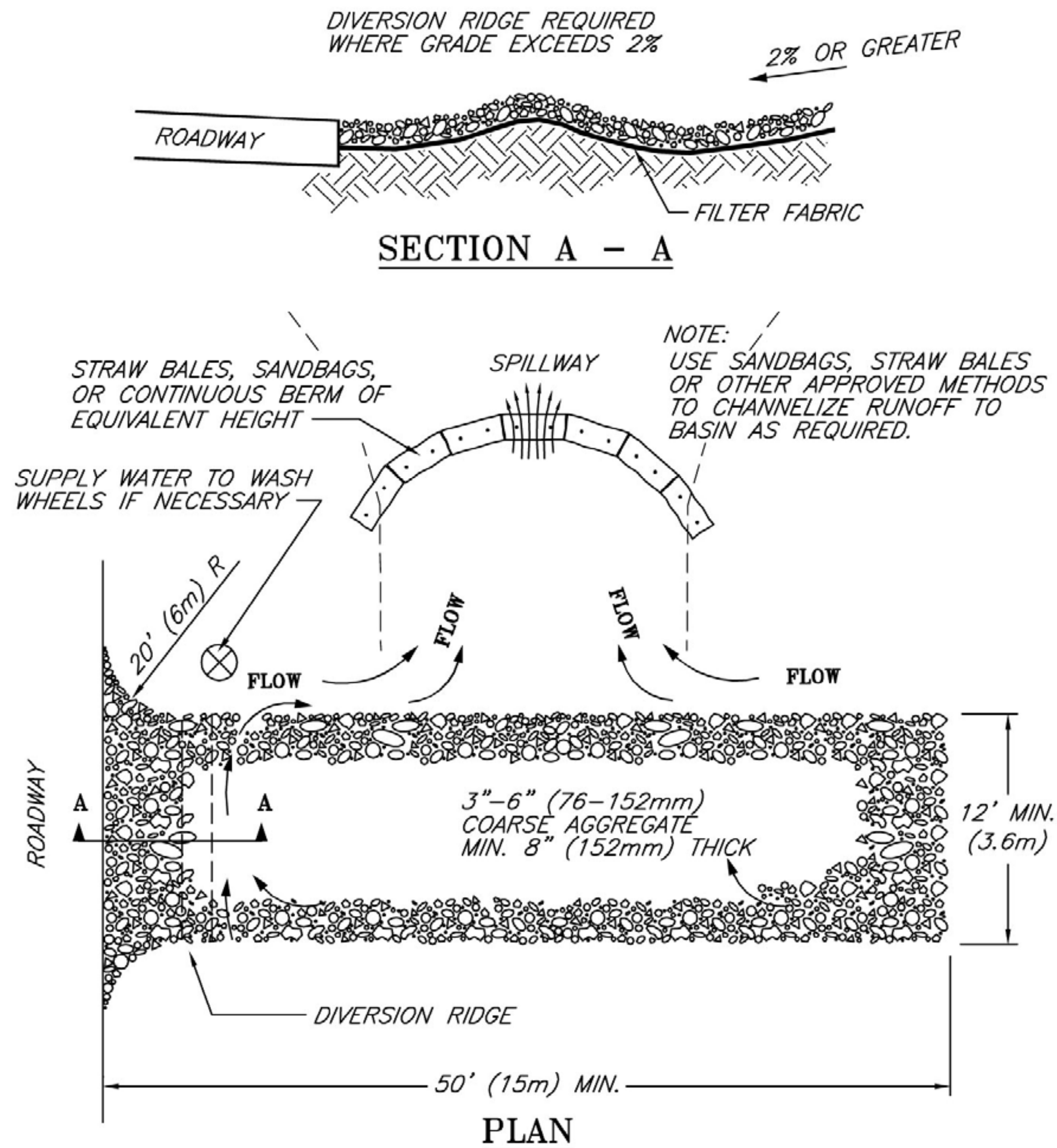
Inspection and Maintenance:

Stabilized Construction Entrance

- Inspect routinely for damage and assess effectiveness. Repair if access is clogged with sediment.
- Where tracking has occurred on roadways sweeping should be conducted the same day. Preferably water should not be used to wash sediment off the streets. If water is used, it should be captured preventing sediment-laden water from running off the site.
- Keep all temporary roadway ditches clear.
- The entrance shall be maintained in a condition that will reduce or prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or maintenance of any measures used to trap sediment.
- Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. Replace gravel material when surface voids are visible.
- After each rainfall, inspect all gravel construction entrances and clean it out as necessary.
- As soon as possible remove all objectionable materials spilled, washed, or tracked onto public roadways. Remove all sediment deposited on paved roadways immediately.

Street Sweeping and Vacuuming

- Inspect entrance and exit points daily and sweep tracked sediment as needed.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- After sweeping is finished, properly dispose of sweeper wastes.



NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT–OF–WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.

2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT–OF–WAY.

3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

FILE: ENTRANCE

Construction Specifications:

- Incorporate with a stabilized construction entrance/exit. See BMP SC-10, "Entrance / Exit Tracking Controls."

Manual/Hose Tire Wash

- Construct on level ground when possible, on a pad of coarse aggregate, greater than 3 inches (75 mm) and smaller than 6 inches (150 mm). A geotextile fabric shall be placed below the aggregate.
- Tire wash shall be designed and constructed/manufactured for anticipated traffic loads.
- Provide a drainage conveyance that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch shall be of sufficient grade, width, and depth to carry the wash runoff.
- Require that all employees, subcontractors, and others that leave the site with mud-caked tires and/or under-carriages use the wash facility.

Temporary Drive-Through Tire Wash

- Minimum dimensions: 40 feet by 12 feet by 1.5 feet (length, width, and sump depth; 12.2 m by 3.7 m by 0.46 m). The minimum length includes ingress and egress from the sump.
- The aggregate size for construction of the pad shall be 4-6 inch (101-152 mm) stone. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
- The thickness of the pad shall not be less than 8 inches (203 mm). Use geotextile fabric under the gravel to improve stability of the foundation.
- Alternatively, install a 3 in. asphalt lift over a stable roadway base with the same dimensions identified above.
- The run out pad should extend 50 feet (15.2 m) past the egress ramp and drain back into the sump or to a suitable collection and treatment facility.
- Install fencing, as necessary, to manage vehicle traffic.

Minimum BMP standards are provided on the following illustrations.

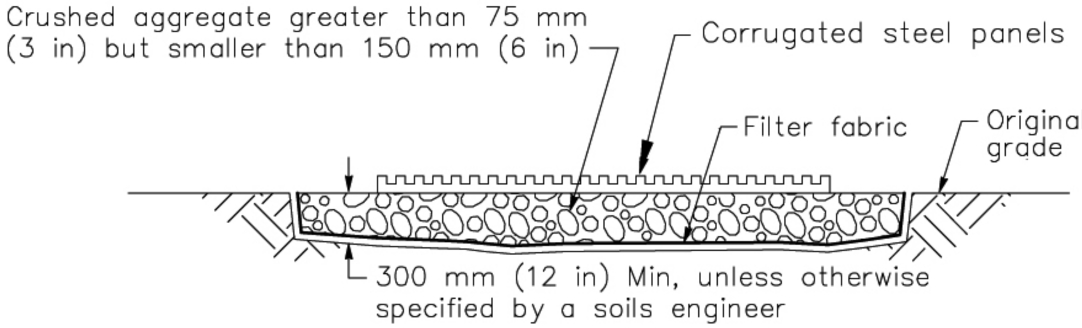
Inspection and Maintenance:

Manual/Hose Tire Wash

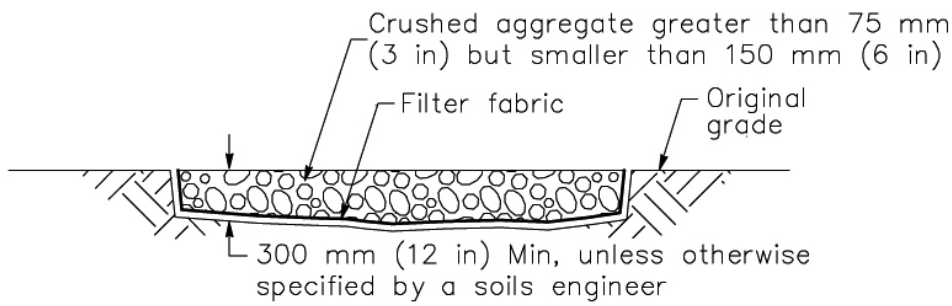
- Remove accumulated sediment in tire wash and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

Temporary Drive-Through Tire Wash

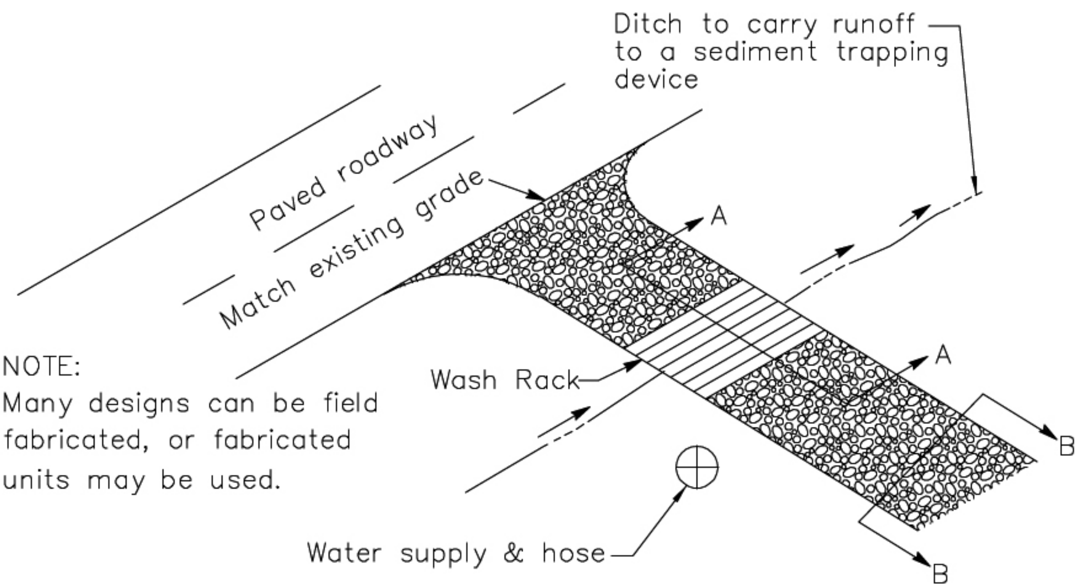
- Inspect routinely to assess the water levels within the sump, the depth of accumulated sediment, and identify any areas that require maintenance.
- Remove accumulated sediment from the tire wash facility to maintain tire wash sump depth. Sediment may be pumped, piped or vacuumed to a suitable collection and treatment facility.
- Clean or replace rock when clogged with sediment and re-grade as needed.
- Maintain the run-out pad as necessary to prevent sediment accumulation.
- Immediately remove any rock that is carried from the pad to the roadway.
- Ensure that wash water drainage, collection and treatment system is functioning.



SECTION A–A
NOT TO SCALE



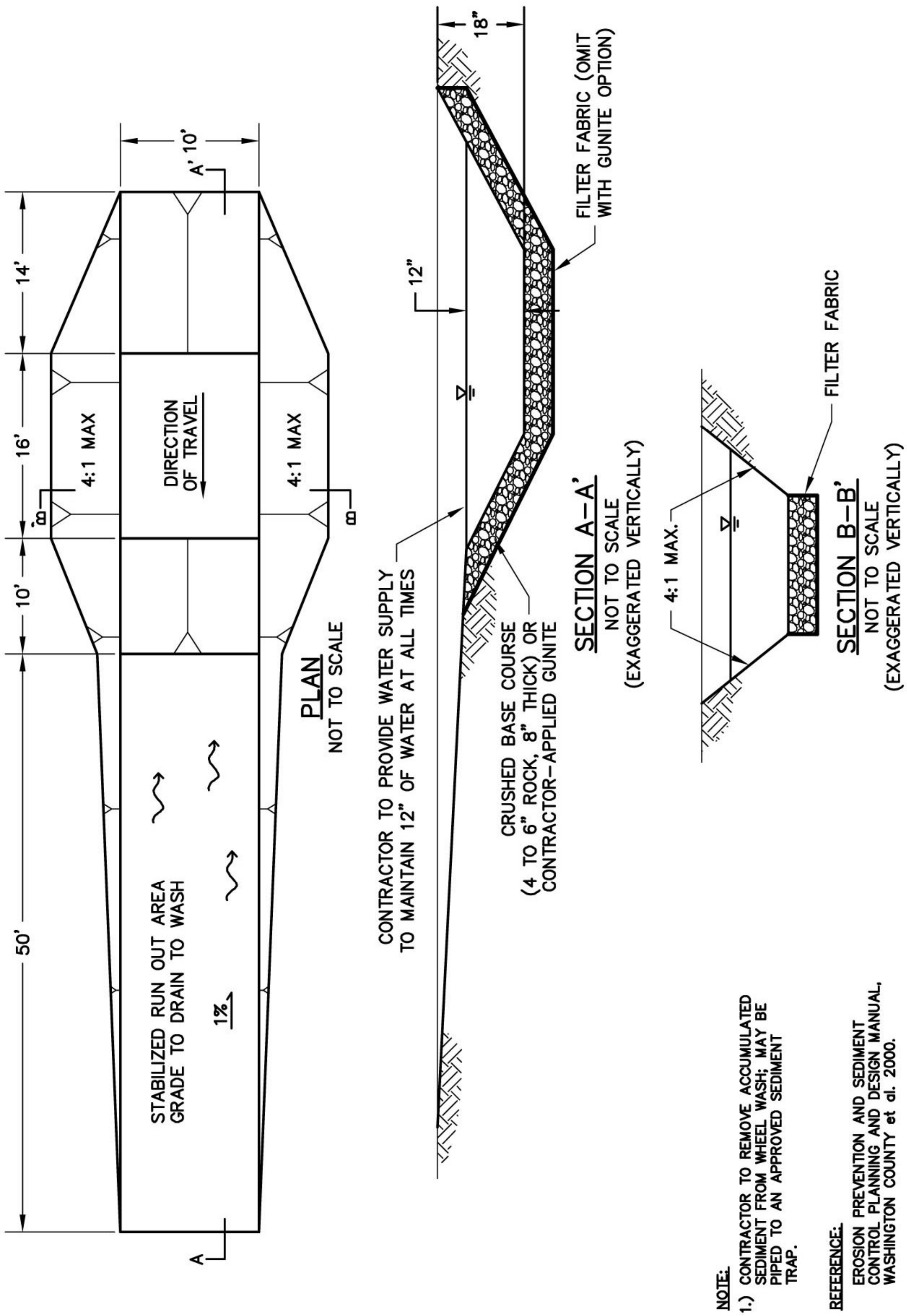
SECTION B–B
NTS



NOTE:
Many designs can be field fabricated, or fabricated units may be used.

TYPICAL TIRE WASH
NOT TO SCALE

MANUAL / HOSE TIRE WASH



TEMPORARY DRIVE THROUGH TIRE WASH

APPENDIX G

NON-STORM WATER POLLUTION CONTROL BMPS

NS-1	Dewatering and Ponded Water Management
NS-2	Paving Operations Controls
NS-3	Temporary Equipment Bridge
NS-4	Illicit Connection / Illegal Discharge
NS-5	Vehicle and Equipment Cleaning
NS-6	Vehicle and Equipment Fueling, Maintenance, and Storage
NS-7	Material Delivery and Storage Controls
NS-8	Material Use
NS-9	Stockpile Management
NS-10	Spill Prevention and Control Procedures
NS-11	Solid Waste Management
NS-12	Hazardous Materials and Waste Management
NS-13	Contaminated Soil Management
NS-14	Concrete Management
NS-15	Sanitary Waste Management
NS-16	Liquid Waste Management
NS-17	Training and Signage

DEWATERING AND PONDED WATER MANAGEMENT – NS-1

Dewatering and ponded water management applies to areas where storm water has collected in low spots, trenches or other depressions and needs to be removed to proceed with construction activities or for vector control. All dewatering discharge activities must be conducted in accordance with local agency (i.e., local sewerage agency or other applicable agency) permit requirements.

Construction Specifications:

- Ponded storm water shall be settled or filtered for sediment removal prior to discharge.
- Water from trench or excavation dewatering shall be tested if required by applicable permits and discharged in accordance with permit provisions.
- For clean ponded storm water, dewatering discharges (without permit requirements), and authorized non-storm water discharges, use one of the following methods for discharge / disposal as allowable by local requirements / agencies and approved by the Project Superintendent. Water shall be clean and free of significant sediment, surfactants, or other pollutants.
    - Reduce sediment discharge by pumping water from the top of ponded areas using a floating or raised hose.
    - Use water where possible for construction activities such as compaction and dust control and landscape irrigation. If used for these applications, ensure that the water will infiltrate and not run-off from the land to storm drain systems, to creek beds (even if dry) or to receiving waters.
    - Infiltrate to an appropriate landscaped, vegetated or soil area. Note: Infiltration may be prohibited in accordance with local requirements.
    - Discharge to an on-site temporary sediment pond.
    - Discharge to the storm drain system. Water from dewatering must not contain significant sediments or other pollutants and discharge must be in accordance with local permits.
- Alternatively, a vacuum truck may be used to remove the water and haul it to an authorized discharge location.
- If a permit is required, provide temporary onsite storage (Baker tanks, etc.) of water removed from trenches, excavations, etc., until a permit to discharge is obtained.
- If a permit is obtained for discharge to a storm drain or sanitary sewer system, conduct all dewatering discharge activities in accordance with permit requirements.

Inspection and Maintenance:

- Inspect pumps, hoses and all equipment before use. Monitor dewatering operations to ensure it does not cause offsite discharge or erosion.
- Inspect routinely, when applicable activities are under way.

Construction Specifications:

- Vehicles and equipment should be washed off site at a controlled wash facility when at all possible.
- Use “dry cleaning methods” such as wiping down whenever possible rather than water washing vehicles on site.
- If cleaning must be conducted on-site, it shall be conducted in a dedicated area with the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses.
  - Paved with concrete or asphalt, or stabilized with an aggregate base.
  - Bermed to contain wash waters and to prevent run-on and runoff.
  - Configured wash area with a sump to allow collection and disposal of wash water.
  - Discharges wash water to a sanitary or process waste sewer (where permitted), or to a dead end sump. Wash waters shall not be discharged to storm drains or watercourses.
  - Used only when necessary.

Additionally, when cleaning vehicles or equipment with water.

- Use as little water as possible. High pressure sprayers may use less water than a hose, and should be considered.
- Use positive shutoff valve to minimize water usage.
- Do not use solvents or detergents to clean vehicles or equipment on site.
- Do not permit steam cleaning on site.

Inspection and Maintenance:

- Inspect and clean work areas regularly to limit wind blow debris and pollutants transported by storm water.

Vehicles and heavy machinery are a potential source of pollutants such as petroleum products, antifreeze, and exhaust and waste oil containing heavy metals. Pollutants may enter storm water runoff by means of direct contact with machine ports and by contact with spills on surfaces and the ground. The following control measures can help prevent contact of these potential pollutants with storm water and ground surfaces.

Construction Specifications:

Fueling - On site vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. When fueling must occur on site, the contractor shall select and designate an area to be used, subject to approval. Vehicle and equipment fueling (including fueling of handheld equipment) shall be conducted in accordance with the following:

- Away from storm drain inlets, drainage facilities, or watercourses.
- On a paved surface where practical.
- Within a bermed area to prevent run-on, runoff, and to contain spills.
- Store portable fuel containers for hand held equipment in a tub or equivalent device to avoid spills and leaks.
- Use secondary containment techniques for fueling of handheld or portable equipment, such as drain pans or drop cloths to catch spills or leaks.
- All fueling shall be conducted with the fueling operator in attendance at all times.
- Use vapor recovery nozzles to help control drips and reduce air pollution and nozzles equipped with automatic shutoff features to prevent overtopping fuel tank.
- Signage that fuel tanks should not be “topped off.”
- An adequate supply of spill clean up materials shall be readily accessible to all fueling activities.

Maintenance - Maintenance of large equipment shall be conducted within designated maintenance yards in order to enable careful management. During minor routine maintenance, drip pans shall be placed under vehicles and equipment. All on site vehicles shall be monitored for leaks and shall receive preventive maintenance to reduce leakage.

Only necessary maintenance required for the proper functioning of handheld equipment and portable generators/compressors is allowed onsite. Drop clothes, trays or an equivalent method shall be used underneath handheld and portable equipment to avoid leaking fluids, fuels, oils, or grease onto the ground. Do not overspray aerosols to the ground or other rain-exposed surfaces. Clean up spills immediately and dispose of waste properly.

Fuel and Vehicle Storage - Fuel storage shall be conducted in accordance with applicable local, state, and federal regulations and in accordance with the BMP for “Hazardous Materials and Waste Management.” Vehicles and equipment shall be stored in designated, bermed vehicle storage areas (such as dedicated storage areas or fueling and maintenance areas) when possible, or off of paved areas to the extent practical. During long periods (typically more than one month) of storage, and when otherwise necessary drip pans shall be placed under vehicles and equipment that are prone to leakage. Plastic tarps shall be placed over exposed equipment when not in use for long periods (>3 mos.) to prevent contact with storm water. All on site vehicles shall be monitored for leaks and shall receive preventive maintenance to reduce leakage.

Inspection and Maintenance:

- Check to ensure adequate supply of spill cleanup materials is available.
- Perform routine inspections of designated maintenance, cleaning, and fueling areas.
- Report all spills immediately to the project Superintendent.
- Service sumps regularly.

MATERIAL DELIVERY AND STORAGE CONTROLS – NS-7

Many materials used in construction can contribute pollutants to storm water runoff. Examples of such materials include soil, vehicle fuels, oils, antifreeze, paints/coatings, pressure treated lumber, dry wall, fertilizers, pesticides, and herbicides.

Construction Specifications:

- All construction materials shall be delivered to and stored in designated areas or designated staging areas at the construction site.
- Material storage areas shall be placed near construction site entrances to the extent practicable, away from storm drain inlets, culverts and surface water bodies.
- Designated storage areas shall be kept clean, well organized, and litter-free.
- Any materials being stored that could release pollutants by wind or runoff transport shall be protected by overhead cover, secondary containment, tarpaulins, visqueen/plastic sheeting or other appropriate method prior to rainfall or periods of high wind. Where feasible, store materials indoors (e.g., container storage or garages/buildings under construction, where work is being conducted.
- Any chemicals, drums or bagged materials not stored in a covered location, shall be stored on pallets, and when possible in secondary containment.
- Secondary containment shall be provided for liquids.
- Secondary containment areas shall be covered, where feasible, to prevent accumulation of rainwater.
- Construction materials shall be stored in a manner to prevent or minimize contact with storm water.
- The main loading, unloading, and access areas shall be located away from storm drain inlets and channels.
- Enclosures or flow barriers (berms) shall be constructed around designated storage areas to prevent storm water flows from entering storm drains or receiving waters, and to control the discharge of sediments and other pollutants.
- Deliveries shall be scheduled in a manner that reduces the time for onsite storage of potentially polluting materials prior to use and minimize the number of material drop locations.
- Fuels shall be stored in accordance with the BMP for “Vehicle and Equipment Fueling, Maintenance, and Storage.”
- Hazardous materials shall be stored in accordance with the BMP for “Hazardous Material and Waste Management.”

Inspection and Maintenance:

- Inspect material storage areas routinely for compliance with the above practices.

MATERIAL USE – NS-8

Apply this BMP when the following materials are used or prepared on site: pesticides and herbicides; fertilizers and soil amendments; detergents; petroleum products such as fuel, oil, and grease; asphalt and other concrete components; plaster; hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds; mastic, pipe wrap, primers, and paint; concrete compounds; welding material; and other materials that may be detrimental if released to the environment.

Construction Specifications:

- Materials shall be used in accordance with manufacturer directions and in a manner to reduce or eliminate release of pollutants
- An accurate, up-to-date inventory of materials delivered and stored on-site shall be kept by each contractor.
- Reduce or eliminate use of hazardous materials on site when practical. Use safer, recycled and/or less hazardous products when practical.
- Use materials only where and when needed to complete the construction activity.
- Recycle residual paints, solvents, non-treated lumber, and other materials.
- Do not remove the original product label; it contains important safety and disposal information.
- Use the entire product before disposing of the container.
- Keep an ample supply of spill clean up material near use areas. Instruct employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall unless sufficient time has been allowed for them to dry or cure.

Inspection and Maintenance:

- Spot check employees and subcontractors monthly throughout the job to ensure appropriate practices are being employed.

STOCKPILE MANAGEMENT – NS-9

Stockpile management procedures and practices are designed to reduce or eliminate air and storm water pollution from stockpiles of soil, sand, and paving materials such as Portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub-base or pre-mixed aggregate, asphalt binder (so called “cold mix” asphalt) and pressure treated wood.

Construction Specifications:

All Stockpiles

- If feasible, locate stockpiles a minimum of 50 feet away from inlets, drainage courses, or water bodies.
- Keep stockpiles organized and surrounding areas clean.
- Protect storm drain inlets, drainage courses, and receiving waters from stockpiles, using drain inlet protection and perimeter sediment controls as appropriate.
- Implement dust control practices as appropriate to prevent wind erosion of stockpiled material.
- Temporary stockpiles not removed or used by the end of one workday must be managed in accordance with this BMP and in all cases protected prior to rainfall.

Stockpiles of soil, Portland cement, sand, mulch, concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub-base

- Protect stockpiles with a perimeter sediment barrier such as berms, sediment fences, fiber rolls, sand/gravel bags, or straw bale barriers year round.
- Stockpiles should additionally be covered or stabilized as necessary during significant forecasted storm events (> 0.25 inches), prolonged periods of rain, and to protect from wind erosion.
- Soil stockpiles may be returned to the excavation if rain is forecast.
- Topsoil stockpiles should be low n height (ideally <1 meter) and flat and be used within 6 months to promote healthy soil organisms and microbes. Stockpiles not used within 6 months should be reseeded with a species that is mycorrhizal dependent to avoid the development of anaerobic conditions in the stockpile.. In addition, topsoil stockpiles can be turned periodically to keep organisms alive for larger stockpiles and during extremely hot weather.

Stockpiles of “cold mix” or other pollutants easily transported in storm water (cement, lime, and other caustic amendments):

- Stockpiles shall be placed on plastic or comparable material at all times.
- Stockpiles shall be covered with plastic or comparable material prior to the onset of significant rain (> 0.10 inches).

Bagged Materials

- Bagged materials shall be placed on pallets at all times and under cover (plastic sheeting, indoors, etc.) prior to the onset of significant rain (>0.10 inches).

Stockpiles/Storage of pressure treated wood with copper, chromium, and arsenic or ammoniacal copper, zinc, and arsenate:

- “Stockpiles” of treated wood shall be covered with plastic or comparable material prior to the onset of significant rain (>0.25 inches).

Inspection and Maintenance:

- Inspect stockpiles regularly and repair and/or replace covers, and perimeter controls as needed.

SPILL PREVENTION AND CONTROL PROCEDURES – NS-10

Spills and leaks can be significant sources of storm water pollutants and are, in *most* cases, avoidable.

Construction Specifications:

- The Contractor shall prepare a site/project specific spill response plan that identifies the type and location of products or wastes on the site with spill potential, the location of spill cleanup materials, storm drains or sensitive areas that require immediate response, personnel responsible for spill response and notifications, and spill cleanup procedures.
- Avoiding spills and leaks is preferable to cleaning them up after they occur. Heavy equipment (e.g., bulldozers and other grading equipment) and vehicles should be inspected daily (or as often as possible) for leaks and should be repaired as necessary. Use secondary containment and drip pans for vehicle fueling, maintenance, and storage (See BMP for "Vehicle and Equipment Fueling, Maintenance, and Storage."
- Despite precautions, spills may still occur at the site. Spills (of liquid or dry materials) should never be cleaned up by hosing off the area. In the event that spills occur they should be controlled as follows:
- Any fuel products, lubricating fluids, grease or other products and/or waste released from vehicles, equipment, or operations shall be collected and disposed of in accordance with state, federal and local laws.
- If the spill has occurred during a rain event, the area will be covered as quickly as possible. The spill will be cleaned up as soon as possible during or after cessation of rain.
- Spill cleanup materials will be stored near potential spill areas (e.g., painting, vehicle maintenance areas).
- **Minor Spills:** Minor spills typically involve small quantities of oil, gasoline, paint, etc. that can be controlled by the first responder at the discovery of the spill. Control of minor spills involves:
    1. Contain the spill immediately.
    2. Recover spilled materials (if possible).
    3. Clean the contaminated area and dispose of contaminated materials.
- **Medium-Sized Spills**: Medium-sized spills still can be controlled by the first responder, along with the aid of other personnel such as laborers, foremen, etc. This response may require the cessation of other activities. Spills should be cleaned up immediately, as follows:
    1. Notify the project foreman immediately. The foreman/superintendent is responsible for any necessary notifications (fire department etc.).
    2. Contain the spread of the spill (using sand bags or other barriers) immediately.
    3. If the spill has occurred on a paved or impermeable surface, clean it up using dry methods (absorbent materials, cat litter, and/or rags). Contain the spill by encircling it with absorbent materials.
    4. If the spill has occurred on an unpaved or permeable surface, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
    5. If the spill has occurred during a rain event, cover/contain the area if possible.
- **Significant/Hazardous Spills:** For large spills or spills involving hazardous materials that cannot be controlled by project personnel, the following steps should be taken:
    1. The Foreman should notify the Project Superintendent immediately and follow up with a written incident report.
    2. The Project Superintendent will notify local emergency response personnel by dialing 911. In addition, the Project Superintendent will notify the appropriate County officials. It is the Project Superintendent's responsibility to have all of the emergency phone numbers at the construction site.
    3. The Project Superintendent will also notify the Oregon DEQ.

4. For spills of federal Reportable Quantity (as established under 40 CFR Parts 110, 117, or 302), the Project Superintendent will notify the National Response Center by telephone at (800) 424-8802 within 24 hours. Within 14 days, the Project Superintendent will submit a written description of the release to EPA Region 10, including the date and circumstances of the incident and steps taken to prevent another release.
5. Retain the services of a Spill Cleanup Contractor or HazMat Team immediately. Construction personnel should not attempt to clean up the spill until the appropriate and qualified staff has arrived at the site.
6. Other agencies that may need to be contacted include the local fire department, Oregon Department of Transportation, etc.

Inspection and Maintenance:

- Inspect work and material storage areas routinely for adequate containment to avoid uncontrolled releases.

Construction Specifications:

- Broom cleaning of paved areas of the site and of paved public areas is preferred. Use of water for cleaning is prohibited unless approved on a project specific basis by the owner. If approved, wash water shall not be discharged to the storm sewer and shall be collected, contained and disposed of appropriate (see bullet below regarding liquid wastes).
- There shall be designated temporary waste storage areas on the site.
- Designated waste storage areas shall be contained within earthen berms or provided with other perimeter protection to prevent run-on to and run-off from the area.
- Non-hazardous construction wastes (e.g., vegetation, trash, and construction debris) shall be collected from throughout the site once a day and before storm events and deposited at the designated waste storage areas.
- When practical, wastes shall be stored within covered, water-tight dumpsters and/or containers that prevent exposure to rain and prevent loss of wastes when it's windy.
- Dumpsters shall not be hosed out on the construction site. Any required dumpster cleaning will be done off-site by the trash hauling contractor.
- Any waste containers constructed on-site (not prefabricated) shall be inspected prior to use and inspected regularly to verify integrity.
- Any wastes stored in open containers or waste piles shall be covered prior to significant forecasted rain (0.25").
- All waste materials shall be removed from the storage areas on a weekly basis or more frequently if capacity is reached and disposed or recycled in accordance with all Federal, state, and local regulations.
- Any solid waste that accumulates at erosion and sediment control devices will be removed ASAP.
- Liquid wastes shall be managed in accordance with the BMP for "Liquid Waste Management."

Construction Specifications:

Hazardous Materials

- Storage of hazardous materials on site shall be minimized. Any hazardous materials used during construction shall be containerized and kept closed during work activities.
- Hazardous material storage shall conform to all applicable local, state and federal requirements.
- Hazardous materials shall be stored in sealed containers within an enclosed container or a bermed and permanently covered storage area. Lids alone shall not be considered adequate cover.
- Dedicated areas of the construction site shall be designated for hazardous material delivery and storage. Designated storage areas will be placed near construction site entrances, to the extent practical, and away from drain inlets, culverts and surface water bodies.
- Designated storage areas shall be kept clean and well organized.
- The following types of materials shall be stored in accordance with these provisions: fertilizers, herbicides, pesticides, detergents, oil, grease, glues, paints, solvents, curing compounds materials, and other similar materials that could be considered potential pollutants in storm water discharge.
- Fuel shall be stored and managed in accordance with the BMP for “Vehicle and Equipment Fueling, Maintenance, and Storage.”
- Regular inspections of storage areas shall be conducted to monitor inventory and check for leaking containers.

Hazardous Wastes

- Hazardous wastes and containers shall be placed in a designated hazardous waste storage area that is permanently covered and has an impermeable bottom surface surrounded by secondary containment to minimize the mixing of wastes with storm water and to prevent the direct release of liquid waste to storm water. Temporary storage and removal of hazardous wastes from the site shall be in accordance with all applicable state and federal laws.
- Wastes shall be segregated and recycled where feasible (e.g., paints, solvents, used oil, batteries, anti-freeze). Wastes shall not be mixed since this can cause potentially dangerous chemical reactions, make recycling impossible and complicate disposal.
- Covered waste bins shall be designated for the disposal of all empty hazardous waste product (e.g., paints, solvents, glues, petroleum products, exterior finishes, pesticides, fertilizers, etc.) containers. The original product label shall not be removed as it contains important safety and disposal information.
- Toxic wastes and chemicals shall not be disposed of in dumpsters designated for construction debris.
- If any asbestos is discovered in the demolished materials, asbestos removal and disposal shall be performed by a licensed contractor or licensed subcontractor trained in asbestos removal. All removal and disposal shall be done in accordance with state and federal regulations. Any asbestos wastes stored on-site prior to removal shall be stored within dumpsters (roll-offs) covered with tarps or other appropriate method to prevent contact with rain and minimize exposure to wind.
- Employees and subcontractors shall be trained on proper storage practices.

SANITARY WASTE MANAGEMENT –NS-15

- All sanitary wastes shall be collected and managed through the use of portable toilet facilities.
- Portable toilets shall be placed on a level surface and to the extent practical, a safe distance away from paved areas and away from storm drains.
- Portable toilets shall be provided with secondary containment.
- If placed in an area of high winds, portable toilets shall be secured to the ground to prevent blowing over.
- Portable toilets shall be transported to and from the construction site by a licensed contractor.
- No sanitary wastes shall be disposed of on site (e.g., to on-site storm drains, burial, etc.).
- Care shall be taken during pump-out to avoid spillage. If spillage occurs it shall be cleaned up immediately.

LIQUID WASTE MANAGEMENT – NS-16

Liquid waste management is applicable to construction projects that generate any of the following non-hazardous by products, residuals, or wastes, such as:

- Drilling slurries and drilling fluids
- Grease-free and oil-free wastewater and rinse water
- Dredging spoils
- Other non-storm water liquid discharges not permitted by separate permits.

Separate BMPs should also be referenced for the following onsite liquid wastes:

- Dewatering operations
- Liquid hazardous wastes, or
- Concrete slurry residue

Construction Specifications:

- Vehicle and equipment cleaning using water is discouraged on site.
- Drilling residue and drilling fluids should be disposed of in accordance with appropriate requirements at an approved disposal site.
- Wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters.
- Contain non-hazardous liquid wastes in a controlled area, such as a lined holding pit, lined sediment basin, roll-off bin, or portable tank.
- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated and any addition volume based on anticipated rainfall.
- Do not locate containment areas or devices where accidental release of the contained liquid can threaten health or safety, or discharge to watercourses, storm drain system, or to a receiving water.
- Capture all liquid wastes running off a surface that has the potential to affect the storm drainage system. Examples are: wash water and rinse water from cleaning walls or pavement.
- If the liquid waste is sediment laden, use a sediment trap or capture in a containment device and allow sediment to settle.
- Disposal of liquid wastes are subject to specific laws and regulations, or to requirements of other permits secured for the construction project.

Maintenance and Inspection:

- Remove deposited solids from containment areas and containment systems as needed, and at the completion of the project.
- Inspect containment areas and containment systems routinely for damage, and repair as needed.

TRAINING AND SIGNAGE – NS-17

When properly trained, site personnel are more capable of managing materials properly, preventing spills, and implementing control practices efficiently and correctly. Personnel at all levels shall be trained in the components and goals of the permit.

Construction Specifications:

The following measures shall be followed to ensure the ESCP is effectively implemented, BMP inspections are performed, BMP maintenance and repair are performed, and appropriate records are prepared and retained:

- Before beginning construction activities and periodically during construction, appropriate personnel shall receive training to implement the ESCP effectively, perform BMP inspections, perform BMP maintenance and repair, and keep records. Non-storm water discharges and general contractor activity BMPs shall also be covered during training. An appropriate forum for training would be "tailgate meetings" or safety meetings that focus generally on the components and goals of the ESCP, and specifically on the implementation, inspection, and maintenance of the storm water pollution control BMPs. Training shall be documented by the contractor.
- Individuals responsible for overseeing, revising, and amending the ESCPs shall also document their training.
- All appropriate new employees and contractors shall be trained by staff familiar with the ESCP requirements before they shall be permitted to work at the site. Contractors shall be responsible for informing their subcontractors about ESCP requirements.
- BMP drawings, trade water quality guidelines, fact sheets, or other specifications shall be copied and distributed to contractors and site personnel engaged in the activity in question and/or installation/maintenance of BMPs.
- Signs shall be placed throughout the job site that convey critical information storm water pollution prevention information such as:
  - • Job Site Clean-Up Required Everyday
  - • Directions to and identification of concrete and paint wash outs
  - • Erosion and Sediment Control Plan in Effect

Attachment 2
Emergency Response Numbers

KEY PROJECT CONTACTS

Oregon LNG's Project Manager

Name ______________________________

Phone numbers: ______________________________

Office ______________________________

Cell ______________________________

Lead Environmental Inspector

Name ______________________________

Phone numbers: ______________________________

Office ______________________________

Cell ______________________________

Contractor Project Supervisor

Name ______________________________

Phone numbers: ______________________________

Office ______________________________

Cell ______________________________

Emergency Response Contractor

Name ______________________________

Phone numbers: ______________________________

Office ______________________________

Cell ______________________________

APPENDIX F2

AGRICULTURAL IMPACT MITIGATION PLAN

Oregon LNG Bidirectional Project

Agricultural Impact Mitigation Plan

Prepared for
Oregon Pipeline Company, LLC

Prepared by CH2M HILL

May 2013

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Definitions

Agricultural Land	Annually cultivated or rotated cropland; land in perennial field crops, orchards, or vineyards; land used for small fruit, nursery crops, greenhouses, or Christmas trees; land in short rotation woody crops on exclusive farm use zoned land; improved pasture, hayfields, land in the Conservation Reserve Program; and previously cultivated land in government sponsored environmental or conservation programs, not including land converted to wetlands.
Drain Tile	Any buried segmented clay pipe or perforated plastic pipe material used to artificially improve subsurface drainage of perched or shallow groundwater within an agricultural field.
FERC Plan	The January 17, 2003, version of the Federal Energy Regulatory Commissions' "Upland Erosion Control, Revegetation, and Maintenance Plan."
Landowner	Person(s) holding legal title to property on the Pipeline route from whom the Oregon Pipeline Company, LLC, is seeking or has obtained a temporary or permanent easement.
Landowner's Designate	Any person(s) legally authorized by a landowner or court of law to make decisions regarding the mitigation or restoration of agricultural impacts to such landowner's property. Any landowner's designate will provide the Oregon Pipeline Company, LLC, with a written document signed by the landowner or a court with jurisdiction authorizing the designate to discuss, negotiate, and reach agreements with the Oregon Pipeline Company, LLC.
Pipeline	Includes the natural gas pipeline(s) and its related appurtenances as described in the Oregon Pipeline Company, LLC, application to the Federal Energy Regulatory Commission.
Tenant	Any person lawfully residing on or in possession of property, and who is the farm operator and has a lease or pays rent on the property that Oregon Pipeline Company, LLC, is seeking or has obtained a temporary or permanent easement from the landowner.
Topsoil	The uppermost part of the soil including the plow layer (Ap horizon) and other A horizons (e.g., A1, A2), but not including transition horizons (e.g., A13, AC, BA, E). It is the surface layer of the soil that generally has the darkest color and the highest content of organic matter.

1.0 Introduction

This agricultural impact mitigation plan (Plan) outlines mitigation measures devised to compensate or mitigate for agricultural impacts that may occur because of construction of the liquefied natural gas (LNG) bidirectional terminal (Terminal) and bidirectional pipeline (Pipeline) (collectively, the Project) being developed by LNG Development Company, LLC, and Oregon Pipeline Company, LLC (together referred to as Oregon LNG). Since the Terminal does not impact any agricultural land, this Plan has been written to address construction of the Pipeline by the Oregon Pipeline Company, LLC (Oregon Pipeline Company).

The purpose of this plan is to provide affected landowners or landowner designates and tenants with a basis for discussions about Project impact mitigation. The mitigation measures[1] in this plan supplement the information provided in the Federal Energy Regulatory Commission (FERC) Natural Gas Act (NGA) Sections 3a and 7c Application for the Project. As such, this plan does not establish any contractual obligations or representations between Oregon Pipeline Company (the applicant) and any party, and does not create any third-party beneficiary rights between Oregon Pipeline Company and any party.

This plan is meant to supplement the FERC Plan and provides an equal or greater level of environmental protection than the FERC Plan. Oregon LNG will comply with all requirements of this plan and the FERC Plan. In the case of inconsistency between this plan and the FERC Plan, the version that provides the highest level of environmental protection shall control.

2.0 Limitations of this Plan

A. The mitigation measures and conditions described in this Plan apply only to construction activities occurring partially or wholly on privately owned agricultural land. They do not apply to construction activities on public right-of-way, railroad right-of-way, publicly owned land, or private land that is not agricultural land, except where agricultural structures such as drainage tile and irrigation systems that are associated with privately-owned agricultural land pass through or extend into these areas.

B. Oregon Pipeline Company will implement the mitigation measures contained in this Plan to the extent that they are consistent with the mitigation measures approved by, or other requirements of, the FERC certificate for the Project. This Plan will impose requirements upon Oregon Pipeline Company only to the extent that such requirements are imposed as conditions of the FERC certificate.

C. Oregon Pipeline Company will implement the mitigation measures contained in this Plan to the extent that they do not conflict with the requirements of any applicable federal, state, and local rules and regulations, and other permits and approvals that are obtained by Oregon Pipeline Company for the Project.

[1] The majority of the conditions and mitigation measures in this plan are adapted from the *Agricultural Impact Mitigation Plan for the South Mist Pipeline Extension Project* prepared by NW Natural (revised and approved March 13, 2003) as a supplement to its application to the Energy Facility Siting Council of the Oregon Department of Energy.

D. Nothing in this document is intended to grant or suggest FERC jurisdiction over remedies for property compensation resolved in accordance with Oregon law.

E. Unless specifically stated otherwise in an easement agreement between Oregon Pipeline Company and a landowner, Oregon Pipeline Company will implement this Plan’s mitigation measures according to the conditions described in the Plan.

3.0 Agricultural Specialists and Inspectors

Oregon Pipeline Company will retain qualified Agricultural Specialists on each work phase of the Project including construction planning, Pipeline construction, restoration, post-construction monitoring, and follow-up restoration. Oregon Pipeline Company will designate one or more of the Environmental Inspectors to serve as the Agricultural Inspector. The Agricultural Inspector will provide technical assistance to Construction Managers, other Project Inspectors, and Oregon Pipeline Company Land Representatives to facilitate the effective implementation of agricultural mitigation measures from the construction through post-construction and monitoring phases of the Project.

Independent Agricultural Specialists will also be retained to seek a mutual agreement between the Oregon Pipeline Company and landowners concerning post-construction claims for damages or crop deficiencies. The qualified Agricultural Specialist will be selected on a claim-by-claim basis by agreement of a representative designated by Oregon Pipeline Company and a representative designated by the party Farm Bureaus (or the landowner, at the election of the landowner).

4.0 Landowner Relations

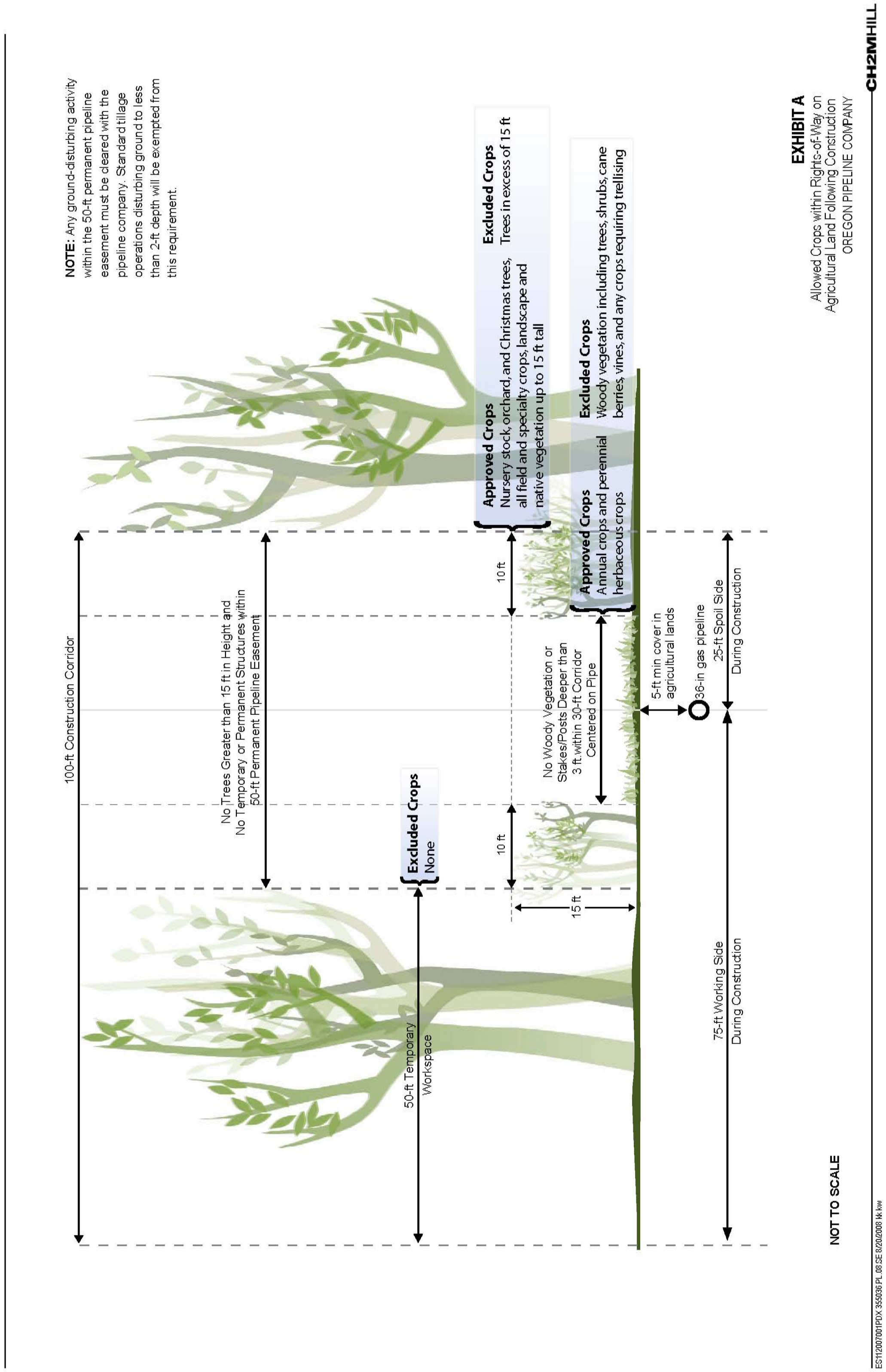
A. Before construction of the Pipeline, Oregon Pipeline Company will provide to each landowner, landowner's designate, and/or tenant the name, telephone number, and mailing address of the Oregon Pipeline Company representative or agent responsible for the liaison activities on behalf of Oregon Pipeline Company both during construction and subsequent operational-related activities. Oregon Pipeline Company will respond promptly to any landowner and/or tenant issues or concerns both during the construction and long-term operational activities.

B. Oregon Pipeline Company will consult with landowners to obtain information on any special certifications that the landowners hold (e.g., certified weed-free seed or hay, organic certification) and to develop plans that will not jeopardize compliance with these certification programs.

C. Oregon Pipeline Company may negotiate with landowners or landowner's designates regarding implementation of mitigation measures that landowners wish to perform themselves.

D. Certain provisions of the Plan require that Oregon Pipeline Company consult with and/or obtain agreement with the landowner and the tenant of a property. Oregon Pipeline Company will make a good faith effort to secure the agreement of both landowner and tenant in such cases. In the event of a disagreement between the landowner and tenant, Oregon Pipeline Company will secure the landowner's agreement unless the tenant can demonstrate a superior legal right in the matter at issue. The standard allowances for crops grown within the 50-foot wide permanent Pipeline easement are shown in Exhibit A.

E. Mitigation measures within the Plan may be modified upon written mutual agreement between Oregon Pipeline Company and the landowner.


NOTE: Any ground-disturbing activity within the 50-ft permanent pipeline easement must be cleared with the pipeline company. Standard tillage operations disturbing ground to less than 2-ft depth will be exempted from this requirement.
100-ft Construction Corridor
No Trees Greater than 15 ft in Height and No Temporary or Permanent Structures within 50-ft Permanent Pipeline Easement
Excluded Crops
None
50-ft Temporary Workspace
10 ft
10 ft
15 ft
No Woody Vegetation or Stakes/Posts Deeper than 3 ft within 30-ft Corridor Centered on Pipe
Approved Crops
Nursery stock, orchard, and Christmas trees, all field and specialty crops, landscape and native vegetation up to 15 ft tall
Excluded Crops
Trees in excess of 15 ft
Approved Crops
Annual crops and perennial herbaceous crops
Excluded Crops
Woody vegetation including trees, shrubs, cane berries, vines, and any crops requiring trellising
5-ft min cover in agricultural lands
36-in gas pipeline
25-ft Spoil Side During Construction
75-ft Working Side During Construction
NOT TO SCALE
EXHIBIT A
Allowed Crops within Rights-of-Way on Agricultural Land Following Construction
OREGON PIPELINE COMPANY
CH2MHILL

5.0 Determining Construction-Related Damages

A. Before construction, Oregon Pipeline Company or its agent together with the landowner, the landowner's designate, and/or the tenant will examine each affected property to inventory crops, livestock, fences, irrigation systems, drain tiles, etc.

B. If construction activities damage crops, Oregon Pipeline Company will compensate the landowner and/or tenant for 100 percent of the damages.

C. Farm improvements such as fences, drain tiles, irrigation systems, and related structures that are damaged as a result of construction activities will be replaced or restored to the preconstruction condition as nearly as possible, or to better condition. In some cases, where Oregon Pipeline Company and the landowner, landowner's designate, and/or tenant agree, Oregon Pipeline Company may provide compensation for construction-related damage to farm improvements in lieu of repair or restoration.

D. Agricultural production of all herbaceous (non-woody) crops can resume on the construction area, including the permanent Pipeline easement, following construction. Woody and deep rooted vegetation including trees, shrubs, cane berries, vines, and any crops requiring trellising that may cause damage to the buried Pipeline may be restricted within the 50-foot wide permanent Pipeline easement. Oregon Pipeline Company may negotiate with landowners, on an individual basis, to allow production of certain specialty crops within its exclusive easement, as long as the proposed activities do not interfere with the safe operation of the Pipeline, or Oregon Pipeline Company's ability to maintain its exclusive easement.

E. Oregon Pipeline Company and the landowner will seek a mutual agreement concerning post-construction claims for damages or crop deficiencies. In the event Oregon Pipeline Company and the landowner are unable to reach a mutually satisfactory agreement, such claims will be assessed on an individual basis by a qualified agricultural specialist. The qualified agricultural specialist will be selected on a claim-by-claim basis by agreement of a representative designated by Oregon Pipeline Company and a representative designated by the party Farm Bureaus (or the landowner, at the election of the landowner). Oregon Pipeline Company must pay the cost of retaining the qualified agricultural specialist. The agricultural specialist will review and evaluate claims of damages. If the agricultural specialist approves the claim, Oregon Pipeline Company will pay compensation for the claim in the amount determined by the agricultural specialist. Claims will be evaluated in a timely manner following notification of such damages or deficiencies from the landowner and/or tenant.

6.0 Mitigation Measures

6.1 Construction Area Access

6.1.1 Ingress and Egress Routes

A. Before Pipeline installation, should access to the construction easement not be practical or feasible from adjacent segments of the construction easement or from public rights-of way, Oregon Pipeline Company will seek a mutually acceptable agreement with the landowner on the route that will be used for entering and leaving the construction easement.

B. Where access ramps or pads are required from a road or highway to the construction area in agricultural fields, an underlayer of durable, geotextile fabric will be placed over the soil surface before installation of temporary rock access fill material. The geotextile fabric will be sufficiently strong to prevent rock from becoming embedded in the soil and to withstand removal of the rock without tearing. Rock and geotextile fabric will be completely removed when the Project is completed.

6.1.2 Temporary Access Roads and Laydown Areas

A. The location of temporary access roads and laydown areas to be used for construction purposes will be negotiated with the landowner and tenant.

B. Oregon Pipeline Company will attempt to identify existing farm lanes as preferred temporary access roads for construction.

C. Temporary access roads and laydown areas will be designed so proper drainage is not impaired and will be built to minimize soil erosion on or near these sites.

D. Oregon Pipeline Company will restore temporary access roads and laydown areas to preconstruction conditions or better, unless otherwise specified in the landowner easement agreement.

E. Upon abandonment, temporary access roads may be left intact through mutual agreement of the landowner, the tenant, and Oregon Pipeline Company, unless located in flood areas or drainage hazard areas, or otherwise restricted by federal, state, or local regulations.

6.1.3 Landowner and Tenant Access

A. Where feasible, Oregon Pipeline Company will coordinate with landowners and tenants to provide access for farm equipment and livestock to fields isolated by the Pipeline trench or other construction activities.

B. Oregon Pipeline Company will construct temporary fences and gates across the construction area, as necessary.

6.2 Depth of Pipeline Cover

A. Except for piping facilities such as mainline block valves, tap valves, meter stations, etc., and except as otherwise stated in this Plan, the Pipeline will be buried with a minimum of 5 feet of cover where it crosses agricultural land.

B. Oregon Pipeline Company will install the Pipeline under existing and planned drain tiles, unless existing or planned drain tiles are located deep enough to allow the Pipeline to be installed above the drain tile with at least 5 feet of top cover over the Pipeline and a 12-inch clearance between the tile and the Pipeline.

C. Where feasible and practicable, Oregon Pipeline Company will install the Pipeline with greater than 5 feet of top cover in agricultural land where specifically requested by the landowner to allow for certain site-specific conditions or practices. Additional construction space may be required for trench spoil storage in these cases.

D. Oregon Pipeline Company will install plastic warning ribbon approximately 18 to 24 inches above the buried Pipeline to provide a greater level of safety for potential excavation activities in the area of the Pipeline.

E. On lands subject to soil erosion, Oregon Pipeline Company will patrol the Pipeline with reasonable frequency to detect erosion of top cover. At a minimum, Oregon Pipeline Company will need to patrol the Pipeline in accordance with Department of Transportation requirements as described in *CFR Title 49 Part 192.705, Transmission Lines: Patrolling* and the FERC Plan . Whenever Oregon Pipeline Company discovers that the loss of cover due to erosion creates a safety hazard, Oregon Pipeline Company will take corrective action.

6.3 Soil Preservation and Restoration

6.3.1 Segregation of Topsoil

A. Oregon Pipeline Company will strip and segregate topsoil from over the trench and from the trench spoil storage area in agricultural lands. Oregon Pipeline Company will also strip and segregate topsoil in agricultural land, over portions of the construction area where grading or cut and fill will occur or where excavations are made beyond the typical trench width.

B. Oregon Pipeline Company will strip and segregate topsoil down to the lower limit of the “A” horizon or to 12 inches in depth, whichever is less.

C. Topsoil will generally not be stripped and segregated on public right-of-way areas, except for the portions used for agriculture.

D. During construction in areas where the topsoil is segregated, the stripped topsoil will be stored separately to reduce further disturbance to the stripped topsoil. The stripped topsoil will not be allowed to mix with trench spoil, cut-and-fill materials, rock, construction debris, excavated materials, or other subsoil. In areas where topsoil is segregated, subsoil will not be stored on topsoil and the topsoil will not be used to pad the pipe, for constructing trench breakers, or for any other purpose that would result in the loss or degradation of the stripped topsoil.

E. Topsoil will be stored in a manner that minimizes an increase in water content by leaving gaps in topsoil piles where surface drainage and ditches occur. Gaps will be left in topsoil piles where livestock and farm machinery crossings are located.

F. When working in excessively wet soils in agricultural land where the topsoil is not stripped, Oregon Pipeline Company will restrict the operation of vehicles and heavy equipment, or will take other appropriate action, so that deep rutting does not result in mixing of topsoil and subsoil.

G. Following backfilling, grading, and subsoil decompaction, the stripped topsoil will be returned to its original position.

H. Original soil contours will be restored, with allowance for settling as necessary. Trench crowns will be constructed where Oregon Pipeline Company determines that trench crowning is necessary to allow for trench settlement.

6.3.2 Removal of Excess Rock

A. The introduction of subsoil stones into the topsoil in agricultural lands will be minimized because Oregon Pipeline Company will segregate topsoil from the trench spoil. Oregon Pipeline Company will replace the segregated topsoil in agricultural lands after the Pipeline is installed and the trench spoil is backfilled.

B. Blasting in agricultural lands is anticipated to be minimal. In agricultural areas over shallow bedrock that require blasting, matting, or controlled blasting will he used to limit the dispersion of blast rock fragments. Suitable precautions will be taken to minimize the potential for oversize rock from blasting or other trenching activities to become interspersed with soil that is placed back in the trench in agricultural areas and to prevent the introduction of rock into the topsoil. Landowners and/or tenants will be given timely notice before blasting on agricultural land.

C. Excess rock, including blast rock, may be used to backfill the trench above the level of the pipe zone material up to the top of the existing bedrock profile.

D. In agricultural land, the top 12 inches within the Pipeline trench, bore pits, or other excavations will not be backfilled with soil containing rocks of significantly greater concentration or size than existed before the Pipeline's construction.

E. Following backfilling and decompaction in agricultural lands, excess rock will be removed from the subsoil surface before the replacement of topsoil.

F. Following the final soil surface treatment, rocks will be removed as necessary so the size, density, and distribution of rock in the construction area will be similar to adjacent areas not disturbed by construction.

G. Where additional soil is necessary to restore the original soil contours as a result of the removal of excess rock from the trench backfill, imported soil will be used but will not be allowed within the topsoil backfill. Imported soil will be consistent in texture and quality with the existing soil in the soil horizon in which it is placed on the affected site.

6.3.3 Mitigation of Soil Compaction and Rutting

A. Where topsoil is stripped in agricultural lands, Oregon Pipeline Company will relieve compaction of the exposed subsoil before replacing the topsoil. Oregon Pipeline Company will relieve subsoil compaction using an agricultural subsoiler or other appropriate implement. After decompaction and before topsoil replacement, a disc or harrow will be used, as necessary, to smooth the subsoil surface.

B. Following final grading and topsoil replacement in agricultural lands, Oregon Pipeline Company will conduct deep tillage to relieve soil compaction in construction areas or will test soils for compaction at regular intervals. Where soil compaction is tested, construction areas will be compared to adjacent areas not disturbed by construction using cone penetrometers or other appropriate devices or methods. Compacted agricultural lands will be treated using a noninversion, deep-tillage agricultural subsoiler specifically designed for soil decompaction and designed to minimize surface disturbance and mixing of subsoil with topsoil.

C. Weather and soil conditions permitting, Oregon Pipeline Company will conduct soil decompaction when soil moisture levels allow for effective soil shattering. Decompaction equipment will not be operated on soils that are too wet, such that a greater level of soil compaction might result.

D. Oregon Pipeline Company will use agricultural subsoiling equipment with shank operating depth and shank spacing that is adequate to effectively relieve soil compaction.

E. Oregon Pipeline Company will make multiple passes of decompaction equipment where necessary to effectively relieve soil compaction.

F. Oregon Pipeline Company will restore rutted areas and leave the soil in the proper surface condition for planting.

G. On agricultural land, Oregon Pipeline Company will complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench on each parcel, weather and soil conditions permitting.

6.4 Construction in Wet Conditions

6.4.1 Impact Avoidance

A. As feasible, Oregon Pipeline Company will schedule most Pipeline construction activities to avoid the months of greatest precipitation

B. On excessively wet soils, Oregon Pipeline Company will restrict certain construction activities such as the operation of heavy equipment, as feasible; or will take other appropriate action, so that soil productivity is preserved or so that soil productivity can be restored and to prevent damage to buried drain tiles and irrigation pipelines.

6.4.2 Trench Dewatering

A. Where it is necessary to pump water from open trenches, Oregon Pipeline Company will pump water into a constructed energy-dissipating structure in a manner that will minimize damage to adjacent agricultural land, drainage systems, and crops.

B. If water-related damages occur to agricultural land as a result of pumping water from open trenches, Oregon Pipeline Company will reasonably compensate the landowner and/or tenant for crop damages, and will either restore the land to the preconstruction conditions or will reasonably compensate the landowner and/or tenant for damage to such land.

C. Pumping of water from open trenches will be conducted so as to comply with Project permits, existing drainage laws, local ordinances relating to such activities, and provisions of the Clean Water Act.

6.5 Protection and Repair of Irrigation and Drainage Systems

A. Before construction, Oregon Pipeline Company will contact landowners and tenants to identify the locations of irrigation systems, wells, and drainage systems. Identified underground irrigation water pipes, well systems, and drain tile lines that intersect the construction area will be flagged to alert construction crews.

B. If underground irrigation water pipes, well systems, or drain tile lines in or adjacent to the construction area are damaged by construction activities or adversely affected by the Pipeline, Oregon Pipeline Company will repair the system to the former condition as nearly as possible in a manner that assures the proper operating condition at the point of repair, or restore the function of the system to the preconstruction condition or better. Such action may include the relocation, reconfiguration, or replacement of the pipe, well, or tile line.

C. At the election of the landowner, Oregon Pipeline Company may negotiate a fair settlement with the affected landowner for the repair, reconfiguration, or replacement of damaged irrigation water pipes, well systems, or drain tile lines. Oregon Pipeline Company will not assume liability for the proper function of water pipes, wells, or drain tile repaired, reconfigured, or replaced by the landowner or the landowner's agent.

D. Oregon Pipeline Company will conduct the repair, reconfiguration, or replacement of damaged water pipes, wells, or drain tiles where the damaged item is part of a system that affects neighboring landowners or is shared by neighboring landowners.

E. Before completing permanent repairs, drain tiles and irrigation pipelines will be examined by suitable means on both sides of the trench for the entire length within the work area to check for damage by construction equipment. If damaged drain tiles or irrigation pipelines are found, they will be repaired to the former condition or better as nearly as possible.

F. Drain tile and irrigation repairs will be made with materials of the same or better quality as that which was damaged.

G. There will be a minimum of 12 inches clearance between the drain tiles (including any support member), irrigation facilities, and the Pipeline.

H. Where an adjacent irrigation pipeline exists, Oregon Pipeline Company will install the Pipeline in agricultural areas with at least the same depth of cover as the existing, adjacent irrigation pipeline.

6.5.1 Irrigation Systems

A. Oregon Pipeline Company will maintain the flow of irrigation water during construction or will coordinate a temporary shut-off with affected parties.

B. Oregon Pipeline Company will repair disrupted irrigation systems as soon as possible and will compensate affected parties for crop losses that result from irrigation system interruptions due to the construction of the Pipeline.

6.5.2 Drainage Systems

Oregon Pipeline Company will repair damaged drain tiles in accordance with the following standards:

A. During construction, any drain tile that is damaged, cut, or removed will be distinctly marked. The marker will be maintained until the drain tile has been permanently repaired.

B. If water is flowing through a damaged tile line, the tile line will be immediately and temporarily repaired until permanent repairs are made. The exposed opening of cut or damaged tile lines where water is not flowing will be covered with filter material as soon as practically possible to prevent the entry of soil or other foreign material.

C. Permanent drain tile repairs will be made within 60 days following the completion of construction on any affected landowners property, weather and soil conditions permitting. Where available, local drain tile contractors will be employed to make permanent repairs of affected tile lines.

D. For permanent repairs where drain tiles are severed by the Pipeline trench:

   i. The damaged section of drain tile line will be replaced by rigid, non-perforated material, unless otherwise directed by the Project Inspector. The replacement section will be approximately the same internal diameter as the existing tile line or larger. The replacement section will be of sufficient strength to withstand typical point loads from construction and farming equipment on the soil surface above the repaired drain tile, or will be supported by a support member.

   ii. A support member will be used to support the repaired tile line where directed by the Project Inspector. The support member will be of sufficient strength to support the drain tile and to withstand typical point loads from construction and farming equipment on the soil surface above the repaired tile line. Support member materials, where necessary, may include plastic half pipe, nonmetallic 90-degree angle support, steel channel iron, steel angle iron, or other suitable materials.

   iii. The drain tile replacement section, and the support member, where used, will extend a minimum of 2 feet (as measured perpendicular to the trench wall) into previously undisturbed soil on both sides of the trench. The drain tile replacement section will extend to undamaged tile line, and an appropriate connector will be installed between the replacement section and the existing drain tile line. Support members, where used, will be installed in a manner that will prevent overturning.

   iv. Where tile repairs involve clay tile, the support member will extend to the first joint beyond the minimum 2-foot distance.

   v. The trench will be backfilled under each drain tile replacement section to obtain positive support that is not prone to settling. As necessary, clean sand will be used to backfill under sections of repaired drain tile.

   vi. The span of the drain tile replacement section over the trench will not exceed 12 feet. If the span of the drain tile replacement section over the trench would exceed 12 feet, the replacement section will be relocated as feasible into undisturbed soil so the subsequent span over the trench is less than 12 feet.

vii. The grade of tile lines will be maintained.

6.6 Identification and Repair of Soil Conservation Practices

A. Oregon Pipeline Company will work with the U.S. Department of Agriculture (USDA), the agency with regulatory authority over federally enrolled conservation easements (e.g., WRP, CREP, CRP, EQIP) to protect sensitive resources and minimize potential adverse impacts.

B. Soil conservation practices such as grassed waterways and terraces that are damaged by the Pipeline construction will be restored to their preconstruction condition as nearly as possible.

6.7 Dust Control

A. Oregon Pipeline Company will control excessive dust emissions generated during construction, as necessary, by the control of vehicle speed, by wetting the construction area, or by other means.

B. Oregon Pipeline Company will coordinate with farm operators to provide adequate dust control in areas where specialty crops are susceptible to damage from dust contamination.

6.8 Soil Erosion and Sediment Control

A. Oregon Pipeline Company will implement erosion prevention and sediment control measures during construction in accordance with the Project's Department of Environmental Quality (DEQ) Construction Stormwater Permit (1200-C) and the FERC certificate and in consultation with agricultural landowners.

B. Following construction, cultivated cropland will generally be reseeded or replanted by the landowner. Oregon Pipeline Company will reseed and mulch non-cultivated agricultural land such as pastures and perennial grass hayfields in consultation with landowners, or will make arrangements with landowners that prefer to conduct the reseeding of these areas.

C. Oregon Pipeline Company will apply temporary mulch in the event of a seasonal shutdown, if construction or restoration activity is interrupted or delayed for an extended period, or if permanent seeding of non-cultivated areas is not completed during the recommended seeding period before the winter season. Temporary straw mulch will be applied to bare soil surfaces, including topsoil piles, at the rate of 4,000 pounds per acre and will be adequately anchored by crimping into the soil or by application of a tackifier. Interim seeding of a cover crop may be used in lieu of temporary mulching in some areas.

D. Following construction, Oregon Pipeline Company will work with landowners and tenants to prevent excessive erosion on cultivated agricultural lands disturbed by construction. Where the landowner or tenant will not plant the area disturbed by construction before the first winter season, Oregon Pipeline Company will plant a temporary cover crop and/or will apply mulch following construction area restoration. The cover crop may be an annual grain, other annual grass, annual legume, or other appropriate species.

E. Permanent erosion control devices such as trench breakers and slope breakers will be installed along the Pipeline. Trench breakers are used to slow the flow of subsurface water along the trench where slopes are steeper than 5 percent. Slope breakers (also called waterbars or diversion berms) are intended to reduce runoff velocity and divert water off the surface of the area affected by construction. Slope breakers will typically be installed following construction as feasible on slopes steeper than 5 percent on non-cultivated agricultural land including pastures. Installation of permanent erosion control devices will be in conformance with the FERC Plan, Sections V.B.1 and V.B.2.

6.9 Weed Control

A. On permanent easement areas where Oregon Pipeline Company has control of the surface use of the land such as aboveground valve sites and metering stations, Oregon Pipeline Company will provide for weed control in a manner that does not allow the spread of weeds to adjacent lands used for agriculture. Herbicide application on such areas will be conducted by an applicator licensed by the State of Oregon.

B. Oregon Pipeline Company will consult with the Oregon Department of Agriculture and other appropriate agencies to determine the location of noxious weeds in the Project area prior to construction. Oregon Pipeline Company will take appropriate action to minimize the spread of noxious weeds in cooperation with the appropriate agency.

C. To prevent the introduction of weeds from other geographic regions, Oregon Pipeline Company will require contractors to thoroughly clean each unit of construction equipment with high-pressure washing before the initial move of those units of construction equipment to the general Project site and when moving equipment out of working areas with known noxious or nuisance weed infestations.

D. Oregon Pipeline Company will use straw bales for erosion control and straw for mulch that are uncontaminated by noxious or nuisance weeds and are certified as weed free.

E. Oregon Pipeline Company will use Oregon certified seed or equivalent for revegetation.

F. For lands subject to Organic certification or where landowners specifically request that no herbicides be used, Oregon Pipeline Company will coordinate with affected landowners to provide alternate methods of weed control.

6.10 Post-Construction Monitoring and Follow-Up Mitigation

Oregon Pipeline Company will actively monitor soil restoration, crop production, tile drainage, and irrigation systems for 2 years following the completion of initial construction area restoration. During the monitoring period, Oregon Pipeline Company will identify remaining soil and agricultural impacts associated with construction that require mitigation and will implement follow-up restoration or appropriate mitigation measures. Follow-up repairs and restoration of damages that are the result of the Pipeline construction will not be limited to the 2-year monitoring period.

6.10.1 Drain Tiles

Oregon Pipeline Company will correct drain tile line repairs that fail because of Pipeline construction, provided those repairs were made by Oregon Pipeline Company. Oregon Pipeline Company will not be responsible for tile line repairs that the company, at the election of the landowner, paid the landowner or the landowner's agent to perform.

To properly drain wet areas in agricultural lands caused by construction or the existence of the Pipeline, additional drain tile or other drainage measures will be installed on the permanent easement and temporary workspace, as necessary, to restore these areas to preconstruction conditions as nearly as feasible.

6.10.2 Excess Rock

On agricultural land, where cultivation or soil settling results in excess surface rock compared to the adjacent area not disturbed by construction, Oregon Pipeline Company will remove and dispose of the excess rock from the permanent and temporary easements.

6.10.3 Trench Settlement

Oregon Pipeline Company will repair trench settlement, as necessary. In agricultural lands where trench settling is excessive and cannot be repaired with minor surface grading; imported topsoil will be used. Oregon Pipeline Company will make reasonable efforts to obtain imported topsoil that is free of noxious weeds. Imported topsoil will be consistent in texture and quality with the existing topsoil on the affected site.

6.10.4 Irrigation Systems

Oregon Pipeline Company will correct problems with irrigation systems resulting from Pipeline construction. Oregon Pipeline Company will not be responsible for irrigation system repairs that Oregon Pipeline Company, at the election of the landowner, paid the landowner or the landowner's agent to perform.

6.10.5 Crop Monitoring

A. Oregon Pipeline Company will conduct onsite monitoring of growing crops at least two times during each growing season during the 2-year monitoring period.

B. The growth of the crop on the construction area (permanent and temporary easement) will be compared with the adjacent area not disturbed by construction or to a comparable area of the field outside the construction area. Visual observations of crop plant vigor, density, height, color, and uniformity will be made.

C. Where significant visual crop deficiencies occur on the construction area compared to the adjacent or comparable area not disturbed by construction, the Agricultural Specialist will determine the need for additional restoration measures.

D. Oregon Pipeline Company will implement additional restoration or mitigation measures, as necessary, in cooperation with affected landowners and tenants.

E. Oregon Pipeline Company will work with affected landowners and agencies to develop a post-construction crop monitoring plan, which will detail standardized methods for inspection and impact evaluation with standardized field checklists to use on all affected properties.

6.10.6 Noxious Weeds

A. Oregon Pipeline Company will monitor the construction areas for noxious weed infestations in conjunction with the crop monitoring described above.

B. Oregon Pipeline Company will take appropriate measures to control new noxious weed infestations that were not identified in the construction area before or during construction.

C. Weed control will be conducted in cooperation with appropriate agencies and with landowners and farm operators.

D. For lands subject to Organic certification or where landowners specifically request that no herbicides be used, Oregon Pipeline Company will coordinate with affected landowners to provide alternate methods of weed control.

APPENDIX F3

CONCEPTUAL MITIGATION PLAN FOR THE OREGON LNG TERMINAL AND OREGON PIPELINE PROJECT

Updated Mitigation Plan

Applicant-Prepared Conceptual Mitigation Plan for the Oregon LNG Terminal and Oregon Pipeline Project

Prepared for

Federal Energy Regulatory Commission

Docket Nos. CP09-6-001 and CP09-7-001

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Prepared by

CH2MHILL®

Contents

Appendices

Tables (located at the end of text, with the exception of the Executive Summary tables)

Figures (located at the end of text, after Tables)

Disclaimer

This conceptual mitigation plan is preliminary and subject to change based on the outcome of ongoing negotiations and reviews with regulatory agencies. Every attempt was made to estimate impacts and areas of mitigation consistent with the analyses presented in resource reports, the *Applicant-Prepared Draft Biological Assessment and Essential Fish Habitat Assessment for the Oregon LNG Terminal and Oregon Pipeline Project*, and the state and federal wetland permit applications (Oregon Removal-Fill, Washington Joint Aquatic Resources Application, and United States [U.S.] Army Corps of Engineers/U.S. Environmental Protection Agency Section 404/10/103 applications). Many state and federal agencies (Federal Energy Regulatory Commission, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, U.S. Environmental Protection Agency, Oregon Department of Land Conservation, Oregon Department of State Lands, Washington Department of Ecology, Oregon Water Resources Department, and U.S. Coast Guard) have jurisdictional authority over resources assigned by state and federal laws. Permit conditions from state and federal agencies will be the final authority on mitigation and conservation measures. Furthermore, impact calculations will be reevaluated during final engineering and design of the Oregon LNG project, and quantities of impacts and mitigation may change slightly. However, although quantities may be modified during final engineering and design, Oregon LNG is committed to the proposed actions and ratios in this document.

Acronyms and Abbreviations

AC	activity center
ATWS	additional temporary workspace
BA	*Applicant-Prepared Draft Biological Assessment and Essential Fish Habitat Assessment for the Oregon LNG Terminal and Oregon Pipeline Project*
BMP	Best Management Practices
BP	Developed (power line corridors and roads)
BPA	Bonneville Power Administration
CAS	Chemical Abstract Service
CF	Conifer Forest
CFR	Code of Federal Regulations
CHU	critical habitat unit
CRMB	Claremont Road Mitigation Bank
dB	decibel(s)
DEIS	Draft Environmental Impact Statement
DF	Deciduous Forest
DPS	Distinct Population Segment
DSL	Oregon Department of State Lands
Ecology	Washington Department of Ecology
EFH	Essential Fish Habitat
EI	environmental inspector
EIR	Environmental Information Request
ESA	Endangered Species Act
ESP	East Bank Skipanon Peninsula
ESU	Evolutionarily Significant Unit
FBB	Fender's blue butterfly
FERC	Federal Energy Regulatory Commission
FISRWG	Federal Interagency Stream Restoration Working Group
>	greater than
HDD	horizontal directional drilling
HUC	Hydrologic Unit Code
IHA	Incidental Harassment Authorization
km	kilometer(s)
LCR	Lower Columbia River
LCRE	Lower Columbia River Estuary
LNG	liquefied natural gas
LNGC	liquefied natural gas carrier
LWD	large woody debris
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MMPA	Marine Mammal Protection Act
MP	milepost
MSDS	Material Safety Data Sheet
N/A	not applicable

NGA	Natural Gas Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rule
OC coho	Oregon Coast coho salmon
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
ORNHIC	Oregon Natural Heritage Information Center
OWEB	Oregon Watershed Enhancement Board
PAC	polyanionic cellulose
PCE	Primary Constituent Element
PEM	palustrine emergent
PFO	palustrine forest
Plan	FERC's *Upland Erosion Control and Revegetation Plan*
Procedures	FERC's *Wetland and Waterbody Construction and Mitigation Procedures*
POTW	Publicly Owned Treatment Works
Project	Oregon LNG Terminal and Oregon Pipeline Project
PSS	palustrine scrub/shrub
RCW	Revised Code of Washington
ROW	right-of-way
SHU	suitable habitat unit
SPCC	Spill Prevention, Control, and Countermeasures
SRF	Snake River fall-run [Chinook]
T&E	threatened and endangered
TEC	Turnstone Environmental Consultants
TWS	temporary workspace
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UWR	Upper Willamette River
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources

Executive Summary

This conceptual mitigation plan describes measures that are prescribed to offset temporary and permanent effects disclosed in the resource reports, *Applicant-Prepared Draft Biological Assessment and Essential Fish Habitat Assessment for the Oregon LNG Terminal and Oregon Pipeline Project* (Applicant-Draft BA) (CH2M HILL, 2013a (Sections 2.6, 5.0, 7.0 and Appendix 13 updated March 2015)[1], and other supporting documents submitted to the Federal Energy Regulatory Commission as part of the Application filed by LNG Development Company, LLC (d/b/a Oregon LNG), and Oregon Pipeline Company, LLC (collectively, Oregon LNG) on June 7, 2013 (Oregon LNG, 2013). Conceptual plans for wetland mitigation and stream crossings are also included. The Application was filed under Section 3 of the Natural Gas Act (NGA) for authorization to site, own, and construct a liquefied natural gas (LNG) receiving terminal and associated facilities (Terminal), and under Section 7 of the NGA to construct, own, and operate a new natural gas pipeline (Pipeline). Additional mitigation planning occurred in collaboration with agencies to identify further measures beneficial to assuring regulatory compliance.

Mitigation Types

Oregon LNG proposes to implement both onsite and compensatory mitigation measures. Extensive studies were conducted to document the presence or absence and location of sensitive species and their habitats. Oregon LNG evaluated alternative site layouts at the Terminal and Pipeline route as due diligence to avoid and minimize effects on sensitive habitats and species. The width of the construction corridor is the minimum necessary for a 36-inch Pipeline. The horizontal directional drilling (HDD) construction technique would be employed in 13 locations to avoid effects on sensitive riparian and stream habitats. Seasonal timing of construction would be an important aspect to mitigation. For example, tree clearing is scheduled in the late spring or early summer, before Pipeline construction, to avoid effects of erosion on steep ground in the Coast Range during the rainy season. In-water water windows would be used to minimize potential effects on fish from dredging and stream crossings. Additional post-construction monitoring is proposed where needed, as described in the body of this plan. Three types of mitigation would be employed to compensate for temporary, long-term, and permanent effects on habitats.

Onsite Mitigation

Proposed onsite mitigation focuses on effects that occur within the footprint of the Terminal and Pipeline facilities. Measures are designed to avoid, minimize, or restore potential effects on natural resources. Strategies include site-specific measures where a practice unique to the site is warranted. For example, the HDD crossing method is a site-specific mitigation measure proposed to avoid and minimize effects on riparian areas, wetlands, migratory bird-nesting habitat, listed species of fish, and other fish-bearing and perennial streams. Most wetland effects would be temporary and restored immediately after construction. Riparian and upland habitats would be restored within the construction corridor. In agricultural areas and near meandering or scouring streams, the Pipeline would be buried with more than the minimum of 3 feet of cover to avoid conflicts with plowing or lateral and vertical movement of streams.

Compensatory Mitigation

Proposed compensatory mitigation focuses on non-site-specific effects. Effects include unavoidable temporal effects on habitats, long-term unavoidable effects, potential "take" of listed threatened and endangered species, and Cowardin class changes to wetlands. Oregon LNG initiated interaction with various regulatory agencies to collaborate on the development of compensatory strategies and approaches. While general strategic approaches

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1 On March 6, 2015, Oregon LNG submitted to FERC updated Sections 2.6 (Mitigation Strategy), 5.0 (Terrestrial Species), and 7.0 (References), as well as additions to Appendix 13 (Northern Spotted Owl and Marbled Murrelet Habitat Assessments and Survey Reports), consisting of the 2014 survey report and the 2015 habitat and impact assessment. Oregon LNG revised these portions of the document in close coordination with the U.S. Fish and Wildlife Service, which has informed Oregon LNG that it is satisfied with the revisions, and with the efforts made by Oregon LNG to avoid and minimize effects to Endangered Species Act-listed species.

were identified, specificity was a goal to ensure that the ecological functions provided in mitigation projects are commensurate with the magnitude and duration of the effects.

For example, compensatory mitigation for effects on listed species of fish focuses on alleviating limiting factors (e.g., access to salmon spawning and rearing habitat), restoring those populations that are most at risk, and implementing high-priority restoration activities consistent with recovery objectives. Specifically, one large mitigation area is proposed to offset negative effects on fish potentially caused by construction and operation of the Terminal. The area consists of 140 acres at the mouth of Youngs River (known as the Youngs River Mitigation Site), where modifications to a levee would reconnect historical floodplain to tidal hydrology. Barriers to fish passage are proposed for removal to promote increased access to productive spawning and rearing habitat. In addition to the Youngs River Mitigation Site, compensatory habitat mitigation in the Coast Range focuses on managing and preserving habitat for late-successional forest, limiting factors for the recovery of the northern spotted owl and marbled murrelet.

Oregon LNG's approach to wetland mitigation follows the United States [U.S.] Environmental Protection Agency, U.S. Army Corps of Engineers (USACE), Oregon Department of State Lands (DSL), and Washington Department of Ecology mitigation sequencing. Where compensation is required, a watershed approach is followed to select available resource replacement sites that offer the greatest functional benefits. Permanent Cowardin class changes from shrub wetland to herbaceous wetland, and forested wetland to herbaceous or shrub wetland, would occur as a result of Pipeline construction and maintenance. Palustrine scrub/shrub wetlands would be restored in situ to the greatest extent possible. Oregon LNG is committed to providing mitigation to compensate for the temporal loss of wetland function.

Unavoidable and permanent effects on wetlands in the Lower Columbia River Basin would be mitigated by establishing the aforementioned Youngs River Mitigation Site at the mouth of the Youngs River. Wetland effects in the Nehalem River basin will be mitigated through restoration, creation, and enhancement of approximately 45 acres of floodplain adjacent to the Nehalem River. The Nehalem River property contains a large remnant river oxbow with an outlet to the river and pastures used for cattle grazing. Functional uplifts would occur by removal of cattle grazing; removal of reed canary to enhance salmon habitat; wetland creation and enhancement in the floodplain through grading and native plantings; and restoration of native riparian floodplain habitat.

Proposed mitigation for wetland effects in the Lower Columbia–Clatskanie River basin in Oregon would consist of funding to a fee-in-lieu project or the Youngs River Mitigation Site. Out-of-kind mitigation focusing on restoration of salmon habitat, a priority in the Columbia River watershed, will be used to compensate for changes in Cowardin class in the Lower Columbia-Clatskanie River basin.

Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

Operational mitigation and post-construction monitoring measures focus on effects that could occur once operations are underway. Restoration within the Pipeline corridor (i.e., upland, riparian, and wetland restoration; stream and streambank restoration) and at offsite compensatory mitigation sites would be monitored to ensure that sites are on a trajectory to meet management objectives. At the Terminal, the shoreline would be monitored quarterly to evaluate shoreline erosion. Bird roosting behavior would be monitored to ensure the Terminal is not stimulating roosting behavior and congregations of birds that may prey on juvenile salmon.

Day-to-day operations are not likely to affect restored habitat or wildlife behavior above the buried Pipeline. However, points of access along the Pipeline would be monitored to ensure the blockage of access by off-road vehicles. The unlikely need for a Pipeline repair could create the potential for adverse effects on the northern spotted owl or marbled murrelet. If unforeseen repairs necessitate activities within 1.5 miles of potential suitable or occupied habitat, then the U.S. Fish and Wildlife Service (USFWS) would be notified and plans developed to implement necessary conservation measures.

Oregon LNG proposes the organization of a formal interagency Adaptive Management Team (Team) to be operative during preconstruction of the Terminal and Pipeline and to continue several years post-construction. The Team would comprise representatives from the USACE, DSL, Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Forestry, Oregon Department of Environmental Quality, USFWS, National Marine Fisheries

Service, USEPA, Washington Department of Fish and Wildlife, and U.S. Coast Guard. Each agency would provide a primary contact and a backup for involvement. The initial charge of the Team would be to review specific mitigation projects and designs for adequacy and compliance with agency design standards. The ongoing role of the Team would be to provide consultation and recommendations in the event of a significant Project modification, emergency, or unanticipated effect on fish and wildlife, and their habitats.

Summary of Proposed Mitigation

Tables ES-1 through ES-5 summarize proposed mitigation for potential effects in each of the following five natural resource area categories:

- Fish and Riparian Areas
- Wetlands
- Upland VegetationNorthern Spotted Owl
- Marbled Murrelet

Each summary table includes proposed actions, corresponding effects, habitat category, effect quantity and duration, and approximate mitigation cost (if known).

The Pipeline construction corridor amounts to approximately 1,100 acres, about 16 percent of which is Category 5 and 6 habitat that does not require compensatory mitigation according to the guidelines stated in Oregon Administrative Rules 635-415-0000 to 635-415-0010, the ODFW Habitat Mitigation Policy.

On the basis of currently assessed effects, Oregon LNG proposes approximately 1,220 acres of compensatory habitat mitigation for the Pipeline in the Coast Range to comply with the ODFW policy. To comply with the August 2014 *Revised Conservation Framework for the Northern Spotted Owl and Marbled Murrelet: Jordan Cove Energy and Pacific Connector Gas Pipeline Project* (Conservation Framework) (USFWS, 2014), Oregon LNG proposes approximately 346 acres and 820 acres of habitat acquisition for the marbled murrelet and northern spotted owl, respectively. Areas of habitat mitigation may be adjusted upward according to Tables 3-2 through 3-5 and 4-3 through 4-6, depending on quality of habitat available for acquisition. Operationally, habitat acquisitions to comply with the ODFW Habitat Mitigation Policy and USFWS Conservation Framework would not be additive. The acquisitions would be stacked in such a manner that each agency's mitigation or conservation requirements are met. For example, "X" acres of habitat acquisition for compliance with the Conservation Framework could be the same "X" acres for compliance with the Habitat Mitigation Policy. Section 3.2.2 in this conceptual mitigation plan describes silviculture and barred owl management options that may be substituted for portions of habitat acquisition strategy to satisfy compliance with the USFWS Conservation Framework.

An additional 140 acres of wetland mitigation would be provided at the Youngs River Mitigation Site for wetland fill associated with the Terminal facilities and Pipeline in the Lower Columbia River watershed. About 13 wetland mitigation credits will be created at the Nehalem River property to compensate for Cowardin class changes from palustrine forest/palustrine scrub/shrub to palustrine emergent within the Nehalem and Lower Willamette watersheds. Oregon LNG proposes to provide approximately 4.4 miles of riparian restoration and enhancement independent of the 1,220 acres of ODFW habitat acquisitions, and to remove seven barriers to fish passage. Removal of the barriers is anticipated to open up at least 7 miles of quality spawning habitat for salmonids.

Proposed compensatory mitigation includes the following commitments:

- Target mitigation acquisitions and conservation easements in blocks as large as possible, strategically located as possible to benefit Endangered Species Act-listed species, and with a focus on older stands
- Manage parcels in the Coast Range for late-successional and old-growth habitat
- Fund long-term management (management planning and implementation, monitoring, and reporting)
- Form an interagency Adaptive Management Team to oversee individual mitigation projects and to oversee accounting that would ensure each agency's requirements are satisfied.

- Commit to develop documents before construction authorization that bind the Project to the mitigation plan and long-term mitigation obligations[2].

The body of this plan provides detailed descriptions of proposed mitigation in the natural resource areas identified above.

2 Instruments are in place for use of the Youngs River and Nehalem River properties for wetland mitigation.

TABLE ES-1
Summary of Compensatory Mitigation for Effects on Fish and Riparian Areas

Action	Effect	Evolutionarily Significant Unit/Distinct Population Segment	ODFW Habitat Category	Ecoregion or HUC of Effect	Mitigation Location	Mitigation Type	Effect Quantity	Units	Duration of Effect	Mitigation Ratio	Mitigation Quantity	Mitigation Units	Approximate Cost (or cost basis for in lieu fee)		Comments
													$$/Unit	Total $$	
Ship water withdrawals (125 ships annually)	Potential fish entrainment in cooling water	Eulachon	N/A	LCRE	None	None	Several thousand	Individual larvae	Annually, November to June	N/A	None	N/A			The small fraction of water in the LCRE affected combined with the very high natural mortality of eulachon larval is expected to have no effect on eulachon at the population scale.
Ship ballast water withdrawals (2 annually)	Potential fish entrainment in ballast water	LCR Chinook	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	Less than 3.62 to 13.81	Individuals, juveniles	Dec/Jan	N/A	140	Acres	Actual cost	Actual cost	Mitigation site near mouth of Youngs River would create additional rearing habitat for many more individual LCR Chinook juveniles than would be affected by construction and operation.
Ship ballast water withdrawals (2 annually)	Potential fish entrainment in ballast water	Snake River Fall Chinook	N/A	LCRE	Within the spawning/ rearing range of the ESU	Remove fish barrier	0.14 to 0.56	Individuals, juveniles	Annual	N/A	1	Project	Actual cost	Actual cost	One barrier removal for combined entrainment and underwater noise take. See Table 5-8 (Fish Barrier Projects Ranked as High Priority in Clatsop, Columbia, and Wallowa Counties) for lists of potential projects.
Ship ballast water withdrawals (2 annually)	Potential fish entrainment in ballast water	Snake River spring/summer run chinook	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	0.01 to 0.07 annually	Individuals, juveniles	Annual	N/A	140	Acres	Actual cost	Actual cost	Youngs RiverProperty would provide environmental benefits to the ESU in excess of the expected annual loss.
Ship ballast water withdrawals (2 annually)	Potential fish entrainment in ballast water	LCR Coho	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	Less than 0.22 to 1.19	Individuals, juveniles	Annual	N/A	140	Acres	Actual cost	Actual cost	Mitigation site near mouth of Youngs River would create additional rearing habitat for more individual LCR Coho juveniles than would be affected by construction and operation.
Ship ballast water withdrawals (2 ships annually)	Potential fish entrainment in ballast water	Unlisted species	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	Not quantified		Annual	N/A	140	Acres			Other species may be susceptible to ballast water entrainment, but would benefit from additional rearing habitat at the mitigation site at mouth of Youngs River and in dredge disposal locations.
Pile driving	Noise	LCR Chinook	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	122	Individuals	One-time	N/A	140	Acres	Actual cost	Actual cost	Mitigation site near mouth of Youngs River would create additional rearing habitat for many more individual LCR Chinook juveniles than would be affected by construction and operation.
Pile driving	Noise	Snake River Fall-run Chinook	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	3	Individuals	One-time	N/A	1	Project	Actual cost	Actual cost	One barrier removal for combined entrainment and underwater noise take
Dredging	Entrainment	All ESA-listed salmonids	N/A	LCRE	Youngs River Property	Reconnect floodplain to estuary	0.3	Percent of time/migratio n habitat	One-time	N/A	140	Acres	Actual cost	Actual cost	Entrainment would only occur if hopper dredge used. Youngs River property would provide rearing opportunities that would more than compensate for dredge entrainment losses.
Dredging	Entrainment	Unlisted species	N/A			Reconnect floodplain to estuary					None proposed				Some small, demersal species may be susceptible to entrainment. Historically entrainment has not been shown to be a significant threat to any species in the LCRE.
Pipeline construction	Loss of LWD recruitment potential	Unlisted species	DF4, DF3, DF2, F4, anCF3	155 total streams with riparian cover within at least 100 feet of the stream bank.	Same as for temporal loss land clearing	Same as for temporal loss land clearing									This includes both streams that do and do not contain ESA-listed fish
Pipeline construction	Fish salvage	OC Coho	N/A	Crossings listed above	Upper or Lower Nehalem 5th Field HUC	Remove fish barrier	178	Individual juveniles	One-time	N/A	2	Project	Actual cost	Actual cost	Only 3% (3) individuals are expected to suffer mortality. See Table 5-8 (Fish Barrier Projects Ranked as High Priority in Clatsop, Columbia, and Wallowa Counties) for lists of potential projects.
Pipeline construction	Fish salvage	LCR coho	N/A	Crossings listed above	Young Bay 5th Field HUC	Remove fish barrier	58	Individual juveniles	One-time	N/A	2	Project	Actual cost	Actual cost	Only 3% (less than one) individual is expected to suffer mortality. See Table 5-8 for lists of potential projects.

TABLE ES-1
Summary of Compensatory Mitigation for Effects on Fish and Riparian Areas

Action	Effect	Evolutionarily Significant Unit/Distinct Population Segment	ODFW Habitat Category	Ecoregion or HUC of Effect	Mitigation Location	Mitigation Type	Effect Quantity	Units	Duration of Effect	Mitigation Ratio	Mitigation Quantity	Mitigation Units	Approximate Cost (or cost basis for in lieu fee)		Comments
													$$/Unit	Total $$	
Clearing riparian vegetation for pipeline construction	Stream temperature	N/A	2, 3, 4	Lower Columbia, Coast Range, Lower Columbia-Clatskanie, Willamette	N/A	N/A	< 1	Degree F per crossing	Modeled for hottest day	N/A	N/A	N/A			Compensatory mitigation would be provided for effects on riparian areas. The minimal functional effect on stream temperature is addressed by providing compensatory mitigation to the temporal loss of habitat function.
Clearing riparian vegetation for pipeline construction	Temporal loss of habitat, including LWD recruitment; 155 streams with existing riparian vegetation	N/A	3, 4	Coast Range	Primarily Nehalem Watershed	Riparian vegetation restoration, enhancement, protection; invasive species control and placement of LWD may accompany vegetation restoration/ enhancement projects.	2.94	Miles	3 to 80 years	1.5:1	4.41	Miles	$100,000 /mile	$441,000	LWD and vegetation projects may occur within the same reach of stream. Projects to occur before completion of Terminal construction (5-year construction period). Conservative estimate based on 100-foot-wide clearing (plans are for -foot clearing at streams)

Notes:
ESA = Endangered Species Act
DF = Deciduous Forest
ESU = Evolutionarily Significant Unit
F = Fahrenheit
HUC = Hydrologic Unit Code
LCR = Lower Columbia River
LCRE = Lower Columbia River estuary
LWD = large woody debris
N/A = Not applicable
OC = Oregon Coast
ODFW = Oregon Department of Fish and Wildlife

TABLE ES-2
Summary of Compensatory Mitigation for Permanent Effects on Wetlands

Action	Effect	Oregon Department of Fish and Wildlife Habitat Category	Ecoregion or HUC of Effect	Mitigation Location (Site, Ecoregion, or HUC)	Mitigation Type	Effect Quantity	Units	Duration of Effect	Mitigation Ratio	Mitigation Quantity	Mitigation Units	$$/Unit	Total $$	Comments
Land clearing, filling, and development; Terminal and Terminal infrastructure	Permanent fill of wetlands	2, 3	Lower Columbia	West bank, mouth of Youngs River	Estuarine enhancement; reconnect floodplain to estuary	33.02	Acres	Permanent	3:1	99.06	Acres	Actual cost	Actual cost	Mitigation project at mouth of Youngs River to serve multiple purposes: estuarine mitigation; PFO mitigation for Pipeline in Lower Columbia HUC; and fish habitat
Clearing; Terminal	Permanent class change of PFO to PSS or PEM	2, 3	Lower Columbia	West bank, mouth of Youngs River	Out-of-kind wetland and salmon habitat	1.9	Acres	Permanent	1:1	1.9	Credit	Actual cost	Actual cost	In-lieu fee bank credits
Clearing; Pipeline	Permanent class change of PFO to PSS or PEM	2, 3	Lower Columbia	West bank, mouth of Youngs River	Estuarine enhancement; reconnect floodplain to estuary	6.91	Acres	Permanent	1:1		Acres	Actual cost	Actual cost	Mitigation project at mouth of Youngs River to serve multiple purposes: estuarine mitigation; PFO mitigation for Pipeline in Lower Columbia HUC; and fish habitat
Clearing; Pipeline	Permanent class change of PFO to PSS or PEM	2, 3	Lower Columbia	Lower Columbia In-Lieu Fee Bank	Out-of-kind wetland and salmon habitat	6.9	Acres	Permanent	1:1	6.9	Credit			In-lieu fee bank credits
Clearing; Pipeline	Permanent class change of PFO to PSS or PEM	2, 3	Nehalem	Floodplain adjacent to Nehalem River	PFO habitat enhancement and preservation	9.82	Acres	Permanent	3:1/1.5:1	See below	Acres	Actual cost	Actual cost	Mitigation with relic oxbow on floodplain of Nehalem River; PFO mitigation and fish habitat
Clearing; Pipeline	Permanent class change of PFO to PSS or PEM	2, 3	Lower Willamette	Floodplain adjacent to Nehalem River	PFO habitat enhancement and restoration, salmon habitat restoration, wetland creation	1.31	Acres	Permanent	3:1/1.5:1	33.81	Acres	Actual cost	Actual cost	Mitigation with relic oxbow on floodplain of Nehalem River; PFO mitigation and fish habitat
Clearing; Pipeline	Permanent class change of PFO to PSS or PEM	2, 3	Lower Columbia-Clatskanie	West bank, mouth of Youngs River	Estuarine enhancement; reconnect floodplain to estuary	4.66	Acres	Permanent	3:1	13.98	Acres	Market rate	Market rate	Mitigation project at mouth of Youngs River to serve multiple purposes: estuarine mitigation; PFO mitigation for Pipeline in Lower Columbia HUC; and fish habitat

Notes:

Credits and effects are not necessarily equal. The number of acres to create a credit is variable and is predetermined as appropriate to compensate for affected functions and acreage. Mitigation banks operate according to an Instrument approved by state and federal agencies (Oregon Department of State Lands, United States Army Corps of Engineers, United States Fish and Wildlife Service, United States Environmental Protection Agency, and Oregon Department of Fish and Wildlife). For example, 3 acres (3:1 acre ratio) may have been required to generate one banking credit.

HUC = Hydrologic Unit Code

PEM = palustrine emergent

PFO = palustrine forest

PSS = palustrine scrub/shrub

TABLE ES-3
Summary of Compensatory Mitigation for Effects on Upland Vegetation

Action	Effect	ODFW Habitat Category	Ecoregion or HUC of Effect	Mitigation Location (Site, Ecoregion, or HUC)	Mitigation Type	Effect Quantity	Units	Duration of Effect	Mitigation Ratio	Mitigation Quantity	Mitigation Units	APPROXIMATE COST (or cost basis for in-lieu fee)		Comments
												$$/Unit	Total $$	
Pipeline land clearing	Temporal loss of habitat to terrestrial wildlife and migratory birds: 50-foot permanent easement	BP, CF, and DF 3, 4	Coast Range	Coast Range	Land acquisition for management of late-successional forest and preservation	384[a]	Acres	3 to 80 years	2:1	768	Acres	Market rate	Market rate	Land acquisition to focus on large blocks of land that would include riparian habitat and provide multiple benefits for migratory birds, marbled murrelet, and northern spotted owl located in the Coast Range. Long-term management objective is late-successional forest. 2:1 mitigation is in addition to onsite restoration. 20 feet of onsite mitigation may grow to mature tree height. 30 feet of onsite restoration may be maintained in shrubs to a height of 15 feet (Category 4 habitat).
Pipeline land clearing	Temporal loss of habitat to terrestrial wildlife and migratory birds: 50-foot TWS and ATWS	BP, CF, and DF 3, 4	Coast Range	Coast Range	Land acquisition for management of late-successional forest and preservation	453[a]	Acres	3 to 80 years	1:1	453	Acres	Market rate	Market rate	Temporary and ATWS would be restored in-kind and onsite in addition to 1:1 compensatory ratio.
Pipeline l and clearing	Primary Constituent Element (PCE) marbled murrelet and northern spotted owl habitat	CF 3, 4, and 5	Coast Range, designated Critical Habitat on state land	Coast Range	Land acquisition for management of late-successional forest and preservation	Variable by species and PCE	Acres	3 to >80 years	N/A	Approx. 1,220	Acres	Market rate	Market rate	Mitigating for PCE effects on PCE habitat would be accommodated by the proposed mitigation for permanent and TWS. Proposed location is in the Coast Range.

[a] Includes upland and riparian buffers.

Notes:

ATWS = additional temporary workspace

BP = Developed

CF = Conifer Forest

DF = Deciduous Forest

HUC = Hydrologic Unit Code

N/A = Not applicable

ODFW = Oregon Department of Fish and Wildlife

PCE = Primary Constituent Element

TWS = temporary workspace

TABLE ES-4
Summary of Adjusted Habitat Acquisition (acres) for Removal and Other Indirect Effects to Northern Spotted Owl

Action	Effect	Mitigation Type	Critical Habitat Subunit	Mitigation Location (Site, Ecoregion, or Hydrologic Unit Code)	Habitat Type [a]	Other Indirect Effects	Habitat Removal	Total	APPROXIMATE COST (or cost basis for in lieu fee)		Comments
									$$/Unit	Total $$	
Pipeline land clearing of designated critical habitat and suitable Northern Spotted Owl nesting habitat	Temporal and permanent loss of habitat to terrestrial wildlife and migratory birds: 50-foot permanent easement	Habitat acquisition for management of late-successional forest and preservation/Barred Owl Management Program	North Coast and Olympic Ranges (NCO-04)	Coast Range	NRF Dispersal Capable Total	175.35 141.46 1.45 318.26	148.96 346.23 6.38 501.57	324.30 487.83 7.83 819.96	Market rate	Market rate	Land acquisition to focus on large blocks of land that would include riparian habitat and provide multiple benefits for migratory birds, marbled murrelet, and northern spotted owl located in the Coast Range. The Conservation Framework provides a rule set for financial support of the barred owl management program. In negotiations with the agency, USFWS proposed to develop a mix of compensatory northern spotted owl mitigation actions, including barred owl management funding, accepted in-lieu of habitat acquisition for up to 25 percent of the obligation for acquiring dispersal habitat. b

[a] Habitat types are defined in Section 3 (Northern Spotted Owl). See Tables 3-2, 3-3, and 3-5 in Section 3 for mitigation ratios.

[b] As discussed in a meeting between the United States Fish and Wildlife Service and CH2M HILL on October 30, 2014.

Notes:

HUC = hydrologic unit code

NRF= nesting, roosting, foraging

TABLE ES-5
Summary of Adjusted Habitat Acquisition (acres) for Removal and Other Indirect Effects to Marbled Murrelet

Action	Effect	Mitigation Type	Critical Habitat Subunit	Mitigation Location (Site, Ecoregion, or HUC)	Habitat Type*	Other Indirect Effects	Habitat Removal	Total	APPROXIMATE COST (or cost basis for in-lieu fee)		Comments
									$$/Unit	Total $$	
Pipeline land clearing of designated critical habitat and suitable marbled murrelets nesting habitat	Temporal and permanent loss of habitat to terrestrial wildlife and migratory birds: 50-foot permanent easement	Habitat acquisition for management of late-successional forest and preservation	North Coast and Olympic Ranges (NCO-04)	Coast Range	Suitable	38.34	14.16	249.58	Market rate	Market rate	Land acquisition to focus on large blocks of land within 52 miles of the coast that would include riparian habitat and provide multiple benefits for migratory birds, marbled murrelet, and northern spotted owl located in the Coast Range.
					Recruitment	42.41	194.13	236.54			
					Capable	15.66	41.29	56.95			
					Total	96.41	249.58	56.95			

* Habitat types are defined in Section 4 (Marbled Murrelet). See Tables 4-3, 4-4, and 4-6 in Section 4 for mitigation ratios.

Note:

HUC = hydrologic unit code

SECTION 1

Introduction

1.1 Purpose

The purpose of this conceptual mitigation plan (Plan) is to summarize proposed mitigation associated with the Oregon LNG Terminal and Oregon Pipeline Project (Project) in a single, comprehensive document. This plan is intended to aid the Federal Energy Regulatory Commission (FERC) with the preparation of a Draft Environmental Impact Statement (DEIS) and facilitate federal and state regulatory collaboration and review.

1.2 Scope

This Plan describes measures that are prescribed to offset temporary and permanent effects disclosed in the resource reports, *Applicant-Prepared Draft Biological Assessment and Essential Fish Habitat Assessment for the Oregon LNG Terminal and Oregon Pipeline Project* (Applicant-Draft BA) (CH2M HILL, 2013a) (Sections 2.6, 5.0, 7.0 and Appendix 13 updated March 2015)[3], and other supporting documents submitted to FERC as part of the Application filed by LNG Development Company, LLC (d/b/a Oregon LNG), and Oregon Pipeline Company, LLC (collectively, Oregon LNG) on June 7, 2013 (Oregon LNG, 2013). Conceptual plans for wetland mitigation and stream crossings are also included. The Application was filed under Section 3 of the Natural Gas Act (NGA) for authorization to site, own, and construct a liquefied natural gas (LNG) receiving terminal and associated facilities (Terminal), and under Section 7 of the NGA to construct, own, and operate a new natural gas pipeline (Pipeline). Additional mitigation planning occurred in collaboration with agencies to identify further measures beneficial to assuring regulatory compliance.

The following subsections further expand on the multifaceted scope of this plan.

1.2.1 Cross-References to Documents Already Filed with FERC

To minimize redundancy, descriptions of the Project, associated facilities, and related actions are not repeated here. Complete descriptions are provided in Resource Reports 1 (General Project Description), 2 (Water Use and Quality), 3 (Fish, Wildlife, and Vegetation), and 8 (Land Use, Recreation, and Aesthetics), filed with FERC on June 7, 2013 (Oregon LNG, 2013), and in the Applicant-Draft BA. Additional references are made to other resource reports filed on June 7, 2013, to the Pipeline Supplement filing in April 2014 (Oregon LNG, 2014a), and to the Supplement filing in December 2014 (Oregon LNG, 2014b).

1.2.2 History and Focus of the Mitigation Described in This Plan

Origins of this conceptual mitigation plan date to 2008, when Oregon LNG initiated discussions with the Oregon Department of Fish and Wildlife (ODFW), United States (U.S.) Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) to vet environmental issues for the proposed Project and to develop strategies for mitigating[4] potential impacts to fish and wildlife habitat. Oregon LNG voluntarily agreed to comply with the ODFW Habitat Mitigation Policy (OAR 935-415-0000 through 0025). Through interagency meetings in 2008 and 2009, Oregon LNG negotiated a conceptual plan for mitigating impacts to fish and wildlife habitat that became the basis for the original submittal of the Plan in September 2009. The original 2009 Plan presented best management practices (BMPs), avoidance and minimization strategies, and summary of compensatory mitigation to address ODFW's Habitat Mitigation Policy, state and federal wetland rules, and conservation measures[5] for listed species

3 On March 6, 2015, Oregon LNG submitted to FERC updated Sections 2.6 (Mitigation Strategy), 5.0 (Terrestrial Species), and 7.0 (References), as well as additions to Appendix 13 (Northern Spotted Owl and Marbled Murrelet Habitat Assessments and Survey Reports), consisting of the 2014 survey report and the 2015 habitat and impact assessment. Oregon LNG revised these portions of the document in close coordination with the U.S. Fish and Wildlife Service, which has informed Oregon LNG that it is satisfied with the revisions, and with the efforts made by Oregon LNG to avoid and minimize effects to Endangered Species Act-listed species.

4 This conceptual mitigation plan follows the definition of "mitigation" provided in Oregon Administrative Rules 635-415-0005 and 141-085-9514.

5 "Conservation measures" is a term used by USFWS in the context of providing actions to preserve endangered species and promote their recovery. "Conserve," "conserving," and "conservation" are defined in 16 United States Code Chapter 35 § 1532. Unlike "conservation," "mitigation" specifically refers to an orderly sequence of avoidance, minimization, rectifying, and compensatory actions. However, both terms embrace best management

of fish and wildlife gathered from resource reports and the Applicant-Draft BA. In 2013, the Plan was revised to address the change in the Oregon LNG project description from an import terminal and inbound pipeline to an export terminal with a bidirectional pipeline. Discussions with USFWS indicated that potential impacts to northern spotted owl and marbled murrelet habitat could be compensated through the mitigation provided in voluntary compliance with ODFW's Habitat Mitigation Policy.

In 2014, USFWS issued a guidance document for the Jordan Cove-Pacific Connector Project, Revised Conservation Framework for the Northern Spotted Owl and Marbled Murrelet: Jordan Cove Energy and Pacific Connector Gas Pipeline Project (Conservation Framework) (USFWS, 2014)[6]. According to USFWS (Young/USFWS, 2014, personal communication), the Conservation Framework is appropriate for use by proponents of linear development projects, where numerous northern spotted owl and marbled murrelet individuals and habitats may be encountered during project construction and operations. Upon the request of USFWS, Oregon LNG analyzed potential impacts to the marbled murrelet and northern spotted owl according to the Conservation Framework and developed conservation measures consistent with the Conservation Framework. Whereas the Applicant-Draft BA originally referred to the Plan for conservation measures pertaining to the marbled murrelet and northern spotted owl, USFWS further requested that such measures be incorporated into the text of the Applicant-Draft BA. Oregon LNG updated portions of the Applicant-Draft BA (Sections 2.6, 5.0, 7.0 and Appendix 13) in March 2015 that included conservation measures for the marbled murrelet and northern spotted owl in accordance with the Conservation Framework.

In an Environmental Information Request (EIR) dated April 9, 2015, FERC requested that Oregon LNG update the Plan. Thus, this revision of the Plan was prepared in response to FERC's EIR. The primary updates in this revision of the Plan were to incorporate conservation measures for the marbled murrelet and northern spotted owl that were submitted with updated sections of the Applicant-Draft BA (Sections 2.6, 5.0, 7.0 and Appendix 13) on March 26, 2015. As a result, two habitat mitigation concepts are incorporated in this Plan: one that demonstrates voluntary compliance with the state ODFW Habitat Mitigation Policy and one that demonstrates voluntary compliance with the federal Conservation Framework. The ODFW Habitat Mitigation Policy and USFWS Conservation Framework required two different approaches to analyzing potential impacts to habitats and two different concepts with differing ratios for habitat mitigation. Habitat acquisition or enhancement with long-term management and conservation easements are the common element to the state and federal approaches to habitat mitigation and conservation of threatened or endangered species.

In this revision to the Plan, the voluntary mitigation and conservation measures that were negotiated with ODFW and USFWS are addressed separately to enable accounting of each agencies mitigation frameworks. However, operationally, habitat acquisition and enhancement projects would not be additive. They would be stacked in such a manner that each agency's mitigation or conservation requirements are met. For example, "X" acres of habitat acquisition for compliance with the USFWS Conservation Framework could be the same "X" acres for compliance with the ODFW Habitat Mitigation Policy. Section 1.2.3.2 describes an adaptive management team that would be created to review individual mitigation projects and track mitigation compliance for the respective agencies represented on the team.

Mitigation described in this plan pertains only to natural resources affected by the construction of the Terminal site, the bidirectional Pipeline, and post-construction operation of those facilities for the life of the Project. The mitigation strategies described do not address any future actions because there are no current plans for further

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practices, strategies to avoid and minimize, and habitat acquisition. Strictly speaking, in ODFW Habitat Mitigation Policy, habitat acquisition would be a compensatory action whereas in an Endangered Species Act context, habitat acquisition is not viewed as compensatory, but rather as a proactive measure to prevent further declines or to promote the recovery to a listed species. While there are nuances to the terms "conservation measure" and "mitigation" as used in the context of state and federal policy, operationally the terms are roughly equivalent. Both terms are used in this Plan.

6 The Conservation Framework "provides direction and methods to quantify and categorize the impacts to [northern spotted owls] (and [marbled murrelets]) and their habitat, and a means to offset these impacts" with respect to the Jordan Cove Energy and Pacific Connector Pipeline Projects currently pending before FERC in Docket Nos. CP13-483-000 and CP13-492-000 (FERC, 2014). The Conservation Framework is included as Appendix Z-4 to the February 2015 Biological Assessment and Essential Fish Habitat Assessment prepared for those projects (FERC, 2015). The Conservation Framework is not binding on Oregon LNG, but provides relevant guidance in certain instances. Thus, this Plan incorporates certain of its voluntary measures.

expansions, nor any future plans for abandonment. Any future actions that might occur would be preceded by submittals of new and separate applications to FERC.

This document presents mitigation measures for resources and species determined to be potentially affected by the Project. Non-Endangered Species Act (ESA) issues involving wetlands, terrestrial habitats, and migratory birds that have been included in any of the previous submittals to FERC are addressed in this Plan, as well. Species that have not been addressed in either the resource reports or the Applicant-Draft BA are not specifically addressed here. Potential habitats for those species are addressed either in mitigation proposed based on ODFW “Mitigation Goals and Standards” (OAR 635-415-0020 through 0025), or by habitats that overlap those included herein. The majority of the mitigation measures consist of BMPs, site and route selection, and facility plans incorporated as design elements intended to avoid, minimize, and restore effects expected to result from the proposed actions.

The mitigation and conservation measures are further intended to provide a context for standards of performance and establish expectations for preconstruction, construction, and post-construction implementation. Although strategies and measures developed in the planning and assessment phase are essentially conceptual, providing specificity has been a primary objective. Efforts to develop specific mitigation have been conducted as a good-faith measure to provide assurances that they would be implemented as intended. The level of specificity varies to a degree. Mitigation has been integrated into Project and facility design, route location and site selection, construction and operational procedures, and post-construction rehabilitation to the greatest degree practicable. These strategies have been planned in detail with the intent of avoiding minimizing, and restoring expected effects “onsite.” Mitigation and conservation strategies intended to address compensatory needs, which are mostly “offsite” projects, are not as detailed, primarily as a result of additional mandated future access, acquisition, partnering, and permitting processes that would subsequently be required once the Project is authorized.

Oregon LNG is in the process of preparing applications for a Section 408 authorization from the USACE and fish passage authorization from ODFW. Mitigation measures that may arise from ongoing negotiations for these agencies is beyond the scope of this updated Plan.

1.2.3 Compliance Monitoring and Adaptive Management

Oregon LNG is committed to constructing and operating the Project in a manner that would minimize environmental effects in compliance with applicable permits and approvals. Oregon LNG would adopt the *Upland Control, Revegetation, and Maintenance Plan* (FERC Plan; FERC, 2013a) without changes and the *Wetland and Waterbody Construction and Mitigation Procedures* (FERC, 2013b) with the approved alternative measures represented in the *FERC Wetland and Waterbody Construction and Mitigation Procedures, Modified by Oregon LNG* (FERC Procedures) (CH2M HILL, 2013b). Other environmental plans and requirements described in the FERC Plan and Procedures and in applicable permits and approvals, would be required for the specifications and drawings issued with the construction bid documents. In addition, the construction contractor would keep copies of these environmental permits and approvals onsite for compliance and inspection.

1.2.3.1. Compliance Monitoring

Oregon LNG would assign environmental inspectors (EIs) (three or more per construction spread) to the Project to monitor environmental compliance. The EIs would have peer status with other inspectors and would report directly to Oregon LNG’s Environmental Project Manager. The EIs would be present throughout construction of Pipeline and aboveground facilities and follow-up restoration activities, and would have the authority to enforce permit and FERC Certificate conditions. The EIs’ roles and responsibilities would be in accord with the FERC Plan and Procedures and would be further described in Oregon LNG’s Implementation Plan. The EIs would be responsible for monitoring and documenting compliance with the FERC Plan and Procedures, as well as implementing mitigation measures required by permits, certificates, and other environmental approvals. The inspectors would be authorized to issue stop-work orders and to require corrective actions to maintain environmental compliance. In addition, the inspectors would act as a liaison between Oregon LNG and field representatives of environmental regulatory agencies who may visit the Project during construction.

Oregon LNG would be responsible for the implementation of environmental requirements during construction of the Project facilities. If, notwithstanding Oregon LNG's best intentions and efforts, a contractor does not comply with environmental requirements during construction, Oregon LNG's EIs would, upon discovery, direct the contractor to comply. If necessary, Oregon LNG's EI would issue a stop-work order for that activity until the noncompliance is corrected. Where applicable, the Commission or other responsible agencies would be notified as required and remedial measures would be implemented.

For a summary of wildlife habitats by ODFW habitat category with proposed mitigation goals, see Appendix A of this report.

1.2.3.2. Adaptive Management

Oregon LNG proposes the organization of a formal interagency Adaptive Management Team (Team) to be operative during preconstruction of the Terminal and Pipeline and to continue several years post-construction. The Team would comprise representatives from the U.S. Army Corps of Engineers (USACE), Oregon Department of State Lands (DSL), ODFW, Oregon Department of Forestry (ODF), Oregon Department of Environmental Quality (ODEQ), USFWS, NMFS, U.S. Environmental Protection Agency (USEPA), Washington Department of Fish and Wildlife (WDFW), and U.S. Coast Guard (USCG). Each agency would provide a primary contact and a backup for involvement. The initial charge of the Team would be to review specific mitigation projects and designs for adequacy and compliance with agency design standards. The ongoing role of the Team would be to provide consultation and recommendations in the event of a significant Project modification, emergency, or unanticipated effect on fish and wildlife, and their habitats. Section 9 of the *Biological Assessment, Columbia River Channel Improvement Project* (USACE, 2001) provides a model for the Team and process.

The Team would be charged with establishing protocols for communications, issuing approvals for significant Project modifications and emergencies, and tracking and accounting for mitigation projects to ensure compliance with each agency's requirements. Team members would meet annually during the anticipated 4-year construction period to review regulatory compliance. Oregon LNG proposes establishing a Web site for updating construction progress and tracking issues that may require interagency coordination during construction and for a period of 2 years following site rehabilitation and restoration. Specific policies would ultimately be the responsibility of the regulatory agency charged with the policy's administration. For example, ODFW would have ultimate authority over state Habitat Mitigation Policy and USFWS and NMFS would have ultimate authority over matters pertaining to ESA and their trust resources.

Post-construction involvement would principally entail timely review of onsite monitoring results and recommendations of actions to be taken when performance standards or ecological objectives as described herein and in federal and state permits have not been sufficiently achieved. The Team would also be expected to provide timely input regarding offsite project plans and permitting, review accomplishment reports, evaluate conservation management plans, and assess monitoring results. Comment from the Team would serve to determine modifications to mitigation applications and strategies that monitoring has revealed need adjustment. The Team would integrate economic and ecologic considerations into innovative collaborative solutions as circumstances warrant. The process would provide opportunities for participating parties to learn, develop, and demonstrate successful methods for achieving joint objectives.

Additional detail and specificity regarding adaptive management approaches and monitoring expectations is provided within each of the individual resource sections in this report.

1.2.4 Regulatory Context and Standards

As documented in Table 1.8-1, Federal and State Agency Review and Permitting, in the Pipeline Supplement (Oregon LNG, 2014a), the regulatory framework for developing this mitigation plan is provided by applicable federal and state law, regulation, and permit requirements. For brevity, the long list of pertinent laws and regulations is not repeated here. In addition to regulatory requirements for mitigation, nonregulatory mitigation needs and measures are addressed in this document, as well.

Selection of appropriate mitigation for effects has followed guidance provided by ODFW in "Mitigation Goals and Standards" (OAR 635-415-0020 through 0025), which specifies general mitigation goals and standards for six categories of habitat value. The ODFW mitigation goals and standards are similar to the USFWS's "Resource Categories and Mitigation Goals," as described in the USFWS Mitigation Policy (USFWS, 1981). The ODFW mitigation goals and implementation standards are summarized in Table 1-1.

The habitat categories in the Project action area were qualitatively categorized based on their importance to fish and wildlife, in accordance with the guidelines stated in Oregon Administrative Rules (OARs) 635-415-0000 to 635-415-0010, the ODFW Habitat Mitigation Policy, during multiple interagency meetings. Washington State does not have a qualitative habitat ranking system or associated habitat mitigation policy. ODFW standards do not preclude mitigation required for compliance with federal and state laws and policies such as the Endangered Species Act (ESA) or the Clean Water Act, for example. In the context of the Project, however, they are intended to serve as goals for avoiding or minimizing effects on both special and non-special-status species. Descriptions of habitat categories are provided in Appendix A.

1.2.5 Best Management Practices

BMP are an integral element of the mitigation plan. Specific measures have been developed to avoid and minimize a broad spectrum of various effects on natural resources. These measures are addressed at length in the individual resource reports (particularly Resource Report 1) and in Appendix B, the *Stormwater Pollution Prevention Plan for Construction of the Oregon LNG Terminal and Pipeline, Including Erosion Prevention and Sediment Control Plan; Spill Prevention, Control, and Countermeasures Plan; and Frac-Out Contingency Plan* (SWPPP; CH2M HILL, 2013c). They include actions and considerations pertaining to the construction, operation, and maintenance of the Terminal and Pipeline, such as the following:

- General Terminal and Pipeline construction procedures, timing, and scheduling
- Grading and clearing activities
- Construction and use of additional temporary workspace (ATWS), and contractor and pipe storage yards
- Trenching procedures
- Locations and activities associated with pipe stringing, bending, and welding activities
- Pipeline corrosion protection
- Pipeline installation and trench backfilling
- Hydrostatic testing
- Protection of forest lands from wildfire
- Restoration and cleanup
- Specialized Pipeline construction procedures on potentially unstable or landslide-prone terrain, agricultural lands, state forest lands
- Railroad, road, and utility crossings
- Waterbody and wetland crossings
- Cleanup and spill prevention
- Temporary construction facilities for the Terminal
- Ground improvements and foundations
- Site access and traffic
- Drainage of the finished site
- Sanitary sewer collection and disposal

- Dredging and dock facility construction procedures

1.2.6 Onsite Strategies

Planning and design considerations, as well as BMPs, are site-level strategies associated with the footprint of the Terminal and Pipeline facilities aimed at avoiding, minimizing, mitigating, or restoring potential effects on natural resources. Strategies include prescriptive approaches where a standardized method is applied; or site-specific approaches where a more detailed practice unique to the site is warranted.

Onsite strategies are intended to prevent certain permanent effects, reduce the risk of regulatory noncompliance, and mitigate temporary effects. Certain measures are to be implemented during or after construction, while others are to be actions carried out during operations. Strategies are prescribed as conditions of licensing and permitting, or according to easement and lease agreements.

Onsite mitigation reduces the adverse effects of a proposed project through the following actions (see Resource Report 8):

- Avoiding the effect altogether by not taking a certain action or parts of an action
- Minimizing effects by limiting the degree or magnitude of the action and its implementation
- Rectifying the effect by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action by monitoring and taking appropriate corrective measures

Oregon LNG initiated site-level planning to avoid and minimize unwanted effects on natural resources. The principles Oregon LNG used in siting the Terminal facilities included the following:

1. Selecting a site where deposition of dredged materials would minimize effects on marine, fish, shellfish, and benthic macroinvertebrate species and their habitats
2. Avoiding to the extent possible habitats for aquatic, riparian, and terrestrial threatened and endangered (T&E) species through careful routing and site selection efforts to minimize potential “take”
3. Selecting route and facility locations adjacent to or parallel with existing access and utility corridors to minimize the amount of clearing; the Project maximizes the use of existing roads to access the Terminal site and Pipeline right-of-way
4. Emphasizing avoidance of estuarine wetlands over avoidance of freshwater (palustrine) wetlands
5. Designing methods and procedures for minimizing effects at waterbody and wetland crossings
6. Developing site-specific mitigation and restoration where possible to address localized concerns, issues, and conditions
7. Identifying post-operation and monitoring needs to further achieve individual resource goals and objectives
8. Designing structures, facilities, and construction procedures that minimize the temporary and permanent disturbance footprint of the Project.

The Terminal layout was designed to balance the excavation volume with the fill volume such that imported fill material would be minimized. The initial conceptual design for the Terminal was a layout in a square that would have extended the area of fill into the low marsh, mudflats, and shallow subtidal areas on the east side of the northern end of the East Skipanon Peninsula. Subsequent layouts were designed along a north-south axis to avoid these high-value habitats. Estuarine wetlands are considered high-quality wetlands because of their importance to salmonids. They have greater surface water connectivity and nutrient contribution. Oregon LNG modified the original layout of the Terminal to avoid estuarine wetland effects as follows:

- The process area (high-pressure LNG pumps and the BOG compressor building) was moved into an area slightly elevated from the surrounding area that separates existing wetlands in the east and west parts of the property.
- Buildings and utility systems were located in the southwest corner of the property to minimize access roads and are in areas that are close to the Skipanon River shoreline away from existing wetlands within the property.

Oregon LNG modified the site layout in 2012 and 2013. Modifications included reduction of vaporization capability, elimination of one of the LNG storage tanks, and modification of LNG spill containment and collection systems, fire protection gas detection and safety systems, stormwater treatment system, ground improvements and foundations, piping, pipe racks, electrical systems, control systems, utilities, telecommunications, structures, access road, and other supporting systems.

The route for the Pipeline and its facilities was selected in an effort to avoid and minimize effects on natural resources. Specifically, the route was chosen to meet the following objectives:

1. Avoid designated conservation areas, National Parks, Monuments, and Wilderness Areas.
2. Avoid critical habitat units for federally listed plants and animals; particularly the northern spotted owl and marbled murrelet.
3. Avoid occupied home ranges and known nest patches of the northern spotted owl and marbled murrelet.
4. Minimize disturbance to sensitive areas (e.g., reduce the number of waterbody crossings, reducing landowner encumbrances by avoiding populated areas, and minimizing disturbance to scenic waterways and /or byways)
5. Minimize effects on public administered lands; about 95 percent of the proposed route would cross privately owned lands.
6. Maximize routing across intensively managed lands (approximately 80 miles of industrial forest in the Coast Range and approximately 5 miles through the Lower Columbia river Basin in Cowlitz County, Washington) to minimize effects on highest-quality wildlife habitat.
7. Maximize co-location with existing utility corridors.
8. Minimize effects on wetlands, particularly those of high value.
9. Minimize location on steep hillsides and avoid unstable slopes.

In addition, Oregon LNG has restricted the size of the proposed temporary work areas to minimize land disturbance during Pipeline construction, but to still provide adequate space for safe construction practices. As previously mentioned, Oregon LNG's construction ROW typically would be 100 feet wide, and the permanent Pipeline ROW would be 50 feet wide. The construction ROW width would be reduced to 75 feet in nonagricultural wetlands. In addition, Oregon LNG proposes to use HDD construction techniques to cross waterbodies that provide habitat for federally listed fish species and certain high value wetlands. Riparian zone effects would be avoided as much as possible through selective Pipeline routing and the judicious use of HDD methods. Oregon LNG has stated that it would retain important specimen trees, significant wildlife snags, and nest trees in riparian areas, where possible. Natural habitat features (e.g., logs greater than 12 inches in diameter, downed LWD, and rocks) would also be retained. These measures would minimize effects on riparian areas, waterbodies, and wetlands important for federally listed species.

The proposed new access roads would not cross wetlands or waterbodies. Existing drainage patterns and culverts would be maintained during construction. Erosion and sedimentation controls would be installed at the limits of the access roads where necessary.

Oregon LNG identified six pipe storage and contractor yards for potential use during the construction of the Pipeline. The sites were selected because of their proximity to the Pipeline route, existing land use, existing railroad accessibility, and access to the sites during construction activities.

In addition to spatial avoidance measures incorporated into the design of the Project, Oregon LNG would implement temporal avoidance measures, such as seasonal restrictions for construction, to avoid effects on species that may be present. Information about seasonal restrictions (e.g., in-water work windows) is discussed in the effect determinations for each species.

1.2.7 Compensatory Mitigation

Compensatory mitigation for the Project has been developed to address issues and concerns related to unavoidable temporal effects on habitats, long-term unavoidable effects, potential "take" of listed T&E species, and regulatory compliance. Oregon LNG initiated interaction with various regulatory agencies to collaborate on the development of compensatory strategies and approaches. While general strategic approaches were identified, specificity was a goal so that unavoidable effects could be compared to planned beneficial treatments for regulatory review.

Compensatory requirements are expected to address unavoidable effects on the following resources:

- Fisheries
- T&E Wildlife Species
  - Marbled murrelet – direct and indirect impacts to habitat
  - Northern spotted owl—direct and indirect impacts to habitat
- Wetlands
- Upland and riparian coniferous forest in the Coast Range
- Special, rare, and unique habitats

Possible strategies for providing necessary and required compensatory mitigation measures considered in this plan include the following:

1. In-lieu, fee-in-lieu payments, or direct purchase of mitigation bank credits designated for funding existing, specified offsite conservation efforts for mitigating unavoidable long-term effects on rare, unique, and wetland habitats
2. Funding of offsite projects to provide like-kind mitigation for unavoidable long-term and temporal effects on upland, riparian, and wetland habitats
3. Land acquisition and conservation easement development to offset unavoidable long-term effects on T&E, estuarine, and wetland habitats, and to compensate for potential "take" of T&E species
4. Funding of experimental projects to control barred owls that are threatening the recovery of the northern spotted owl
5. Contingency strategies in the event preconstruction surveys result in a "detection" of a T&E species in previously unoccupied suitable habitat

The objectives of compensatory mitigation development are to describe the resource type(s) and amount(s) that would be provided, the method of compensation (e.g., restoration, establishment, preservation), and how the anticipated functions of the mitigation project would address needs. Where possible, compensatory planning should also account for the following:

- Site selection, including a description of the factors considered during the selection process
- Baseline information such as a description of the site's characteristics
- A description of the legal instruments or arrangements that would be pursued to ensure long-term protection of the mitigation project site (for example, easement agreements, credit purchases, ownership, management requirements)

- Determination of credits or the ratios utilized to estimate the amount of compensatory units needed and a brief explanation of the rationale used

Specific mitigation project plans have not yet been fully developed, and would necessitate continued coordination and collaboration with regulatory agencies. Additional planning should consider detailed specifications and work descriptions for a mitigation project, including the following:

- Geographic boundaries of the project
- Construction methods
- Timing and sequence
- Source(s) of materials or water
- Methods for establishing the desired plant community
- Plans to control invasive plant species
- Proposed grading plan or plan geometry and form
- Maintenance and long-term management plans and schedule to ensure the continued viability of the resource
- Ecologically-based performance standards that would be used to determine whether the mitigation project is achieving its objectives
- Monitoring requirements, scheduling, reporting, and parameters to determine whether the mitigation project is on track to meet performance standards and if adaptive management is needed
- An adaptive management strategy to address unforeseen changes in site conditions or other components of the mitigation project
- A description of financial support that would be provided and how they are sufficient to ensure a high level of confidence that the mitigation project would be successfully completed, in accordance with performance standards
- Additional information as necessary to determine the appropriateness, feasibility, and practicability of the mitigation project

The level of detail described above would be provided in conjunction with specific permit applications or in advance of specific project implementation.

1.2.8 Physiographic Regions and River Basins

Mitigation measures and prescriptions have been formulated with site characteristics and physiographic factors in mind. Local and regional variations of the endemic physical and biological environment have been considered according to ecoregion and 4th-field hydrologic unit. The two principle ecoregions are the North Oregon Coast Range (including the Coastal plains), and Lower Columbia River Basin in Cowlitz County, Washington. The main 4th-field river basins consist of the Lower Columbia River (LCR) (including the Youngs and Lewis & Clark watersheds) the Nehalem River, and Lower Columbia/Clatskanie.

1.3 Organization

This document is organized by primary resource topics and issues. Onsite, compensatory, and operational mitigation are addressed under individual primary resource headings (for example, Fish), followed by a description of post-construction monitoring. Appendices are substantive in supporting discussion and issues addressed in the text.

SECTION 2

Preconstruction Surveys and Studies

Preconstruction surveys and studies in the form of field investigations were conducted to facilitate Project planning and design, perform effects analyses, address regulatory compliance, develop conservation strategies, and determine site-specific needs. The surveys and studies that were conducted greatly benefited identification of the onsite and compensatory mitigation needs addressed in this Plan. Detailed methodology, results, and discussion can be found in the resource reports and Applicant-Draft BA.

Summary-level information from preconstruction surveys and studies is included in the individual resource sections of this report. Field observations and assessment of wildlife habitat followed Oregon LNG wildlife and T&E species protocols (see Resource Report 3, Appendix 3D).

Preconstruction surveys and studies conducted to date include the following:

- Habitat categorization development for comprehensive multispecies characterization to address the ODFW Oregon Conservation Strategy and Mitigation Policies
- Oregon Conservation Strategy Habitats and Associated Strategy Species Review, August 2008
- Oregon LNG Habitat Assessment and Mapping, 2005, 2007, 2011, 2012
- Wildlife Inventory, Spring/Summer 2005
- Northern Spotted Owl and Marbled Murrelet Habitat Assessment, 2008, 2012, 2015
- Marbled Murrelet Surveys 2008, 2009, 2012, 2014
- Northern Spotted Owl Surveys, 2008, 2009, 2012
- Review of 2012 Proposed Critical Habitat (for northern spotted owl), August 2012
- Rare Plant Surveys, spring and fall 2008, Rare Plant Desktop Study, 2013
- Invasive Vegetation Surveys, Summer and Fall 2007
- Skipanon Peninsula Wildlife Survey - Skipanon Peninsula, Spring 2007
- Amphibian and Reptile Survey—Oregon LNG Terminal, June 2008
- Stream Characteristics Surveys, 2007/2008, 2011/2012
- Taxonomic Composition and Density of Benthic Macroinvertebrates Surveys at Oregon LNG's Proposed Dredge Site in the Lower Columbia River Estuary, Spring 2008

SECTION 3

Northern Spotted Owl

Proposed Project mitigation measures for the northern spotted owl address Section 7(a)(1) of the Endangered Species Act, which directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. Conservation measures proposed by Oregon LNG are consistent with the August 2014 *Revised Conservation Framework for the Northern Spotted Owl and Marbled Murrelet: Jordan Cove Energy and Pacific Connector Gas Pipeline Project* (Conservation Framework) (USFWS, 2014). The package of conservation measures would potentially include a suite of activities: BMPs related to conducting surveys, timing of construction, and avoidance of certain activities during the breeding season; habitat acquisition; silvicultural treatments with or without habitat acquisition; and contributing to programs to control barred owls.

Potential effects of actions related to the Project are addressed in of the Applicant-Draft BA. The revised recovery plan for the northern spotted owl (USFWS, 2011) identifies the most important range-wide threats to the spotted owl: competition with barred owls, ongoing loss of spotted owl habitat as a result of timber harvest, habitat loss or degradation from stand replacing wildfire and other disturbances, and loss of amount and distribution of spotted owl habitat as a result of past activities and disturbances.

Demographic studies suggest that northern spotted owl numbers continue to decline, with estimates ranging from 2.9 percent to 3.7 percent annually (USFWS, 2011). Population numbers are declining throughout the species' range, including the northern portion of Oregon's Coast Range. Management options outline in the 2011 revised recovery plan focus on the habitat conservation network of the Northwest Forest Plan, in addition to the following recommendations:

- Target research and management efforts to address the increasing threat from the barred owl
- Retain more occupied spotted owl sites and unoccupied, high-value spotted owl habitat on all lands. Vegetation management actions that may have short-term effects but are potentially beneficial to occupied spotted owl sites in the long-term meet the goals of ecosystem conservation. Such actions may include silvicultural treatments that promote ecological restoration and are expected to reduce future losses of spotted owl habitat and improve overall forest ecosystem resilience to climate change, which should result in more habitat retained on the landscape for longer periods of time.

Habitat recovery is focused on preserving high-quality nesting, roosting, foraging habitat (characterized by large trees, high canopy cover, multistoried canopy, and sufficient downed wood to support prey species) for northern spotted owls, as well as dispersal habitat and moderate-quality habitats that can be expected to develop into nesting, roosting, foraging over time (USFWS, 2011). The northern portion of the Coast Range has been extensively logged, particularly on private industrial forests. Industrial forest lands are typically maintained on a 60-year or less rotation. The northern portion of the Coast Range currently is not a target area for recovery because of forest management practices and competition from barred owls (Thomas et al., 1990).

Designated critical habitat for the northern spotted owl was recently revised (*Federal Register*, 2012). The Project passes through spotted owl critical habitat unit NCO-04 near milepost (MP) 41.3. Approximately 49 acres of designated critical habitat containing PCEs identified by USFWS as essential to conservation of northern spotted owls, would be affected by the action (Turnstone Environmental Consultants [TEC] and CH2M HILL, 2015).

3.1 Onsite Mitigation

When the Project was first conceived, the Pipeline would have crossed five home ranges (CH2M HILL, 2009). As a conservation measure, the current Project with a Pipeline route modified from the originally conceived LNG import project, has avoided impacts to the northern spotted owl by reducing the number of home ranges that would be crossed. The Pipeline route avoids existing occupied northern spotted owl sites and their core and home ranges. The route does not cross through any known occupied habitats.

Surveys in areas adjacent to the Pipeline (within a 1.5-mile radius) that contained potentially suitable spotted owl habitat were conducted in the 2008, 2009, and 2012 nesting season (April to mid-August). A total of 117 calling stations covering approximately 17,864 acres of potentially suitable spotted owl habitat were surveyed.

During the 2008 and 2009 northern spotted owl survey season, Oregon LNG conducted surveys on properties owned by Weyerhaeuser Corporation, Stimson Lumber Company, ODF, and assorted smaller private landowners. Surveys were conducted in areas adjacent to the Oregon LNG Pipeline (within a 1.5-mile radius) that contained potentially suitable northern spotted owl habitat. The survey protocol is described in Appendix 13 (Northern Spotted Owl and Marbled Murrelet Habitat Assessments and Survey Reports) of the Applicant-Draft BA. Oregon LNG surveyed a total of 101 calling stations in potentially suitable northern spotted owl habitat near the Pipeline corridor. In 2012, Oregon LNG surveyed a total of 16 calling stations in areas of the Pipeline on land owned by ODF and Weyerhaeuser Corporation. No spotted owl surveys were conducted by Oregon LNG in 2013 or 2014 due to landowner restrictions.

Oregon LNG did not encounter northern spotted owls during the surveys in 2008 and 2009, but surveyors did observe 25 barred owls, 2 northern saw-whet owls, 5 western screech owls, and 2 northern pygmy owls. No spotted owls were identified during the 2012 surveys conducted by Oregon LNG, but surveyors reported observations of barred owls and northern saw-whet owls.

Oregon LNG analyzed potential impacts to northern spotted owl habitat in accordance with the Conservation Framework. Habitat impacts were summarized in Section 5.3.2 of the Applicant-Draft BA. Fieldwork conducted in 2008, 2009, and 2012 can be summarized as follows:

- There were no northern spotted owl detections in 2008.
- There were no northern spotted owl or marbled murrelet detections in 2009.
- There were no northern spotted owl detections in 2012.
- Two years of protocol surveys for northern spotted owls were completed on August 18, 2009.

Oregon LNG would apply measures that minimize effects primarily onsite at the time of Project construction through implementation of Best Management Practices. The following mitigation recommendations are intended to avoid, minimize, or restore effects and promote the recovery of spotted owls:

- Survey for northern spotted owls in suitable habitats in the action area to document presence or absence (survey completed).
- Provide survey results of monitoring efforts to USFWS as they become available in order to maintain and update baseline information and to facilitate future consultations[7](see Appendix 13 [Northern Spotted Owl and Marbled Murrelet Habitat Assessments and Survey Reports] to the Applicant-Draft BA for updated survey information).
- Avoid the removal of suitable northern spotted owl nesting, roosting, and foraging habitat during the breeding season (March 1 to September 30).
- Avoid Pipeline installation and access road construction activities within 35 yards of owl sites during the Critical Breeding Period (March 1 to July 7).

[7] A considerable amount of the Project's action area (miles 1 to 33 and 50 to 89) was not surveyed to protocol by Oregon LNG due to landowner concerns. However, Oregon LNG was able to evaluate the availability of suitable northern spotted owl habitat in unsurveyed areas via remote sensing and found insufficient suitable habitat to support northern spotted owl. The ODF surveys all areas in the Project's action area with sufficient habitat to support owls (approximately miles 34 to 49). Oregon LNG used the GIS-based Biomapper® software to assess habitat suitability for both marbled murrelets and northern spotted owl, which was recommended by USFWS for identifying suitable habitat for both species (Smith, 2007, personal communication). When evaluating habitat suitability for northern spotted owl, "forested" and "not dispersal" attributes were selected to identify areas of capable habitat. Analyses were conducted in accordance with the Conservation Framework.

- Avoid more than 3 consecutive days of any construction activities within 0.25 mile (greater than 35 yards) of owl sites during the Critical Breeding Period.
- Restrict habitat removal within suitable, dispersal, or capable habitat areas to avoid the Critical Breeding Period.
- Restrict construction use of heavy equipment, chainsaws, and cable yarding within 0.25 mile of occupied sites.
- Restrict blasting, slash disposal, and burning within 0.25 mile of an occupied site during the breeding season (March to September).
- Restrict helicopter yarding over an occupied site or its associated buffer zone during the breeding season (March to September).
- Minimize clearing and construction for new access roads to reduce removal of potential dispersal or NRF habitat and creation of new forest edges.
- Compensatory conservation measures would be provided commensurate with impacts. Compensatory conservation measures would take the form of a combination of habitat acquisition, silviculture treatments, and barred owl management as described under Conservation Measures in Section 5.3.2 of the Applicant-Draft BA.
- Acquired habitat and land on which silviculture treatments are applied would be preserved and managed to maintain and restore old-growth habitat, as described in Section 5.3.2 of the Applicant-Draft BA.
- Specific compensatory conservation projects would require approval from USFWS.

3.2 Compensatory Mitigation

This section reviews effects and mitigation for the northern spotted owl. Direct effects on the northern spotted owl are avoided .

3.2.1 Effects

Two documented owl ACs are located within a 1.5-mile range of the Pipeline. A documented owl site is any site where there has been a recent or historical observation of a resident single spotted owl or a pair of owls. ODF is currently conducting surveys for both of these ACs. The ACs include:

- McGregor Road. The McGregor Road AC is a historical nonresident single site and is not known to be historically occupied by nesting adult spotted owls.
- Wolf Creek. This AC is a nesting site historically occupied by nesting adult spotted owls.

The location and activity records for sites were obtained from the Oregon Natural Heritage Information Center (ORNHIC), ODF, and Weyerhaeuser Corporation.

These two known sites are located on public land managed by ODF. The ACs and the nonresident single areas are usually surveyed every year by contractors hired by ODF. If a documented spotted owl AC does not contain a male/female spotted owl pair for 3 consecutive years, its status may be changed from an active pair site to a historical pair site. None of the sites within 1.5 miles of the Pipeline route had any observations or detections of spotted owl during the 2008, 2009, or 2012 survey seasons.

On the basis of the evaluation in the Applicant-Draft BA of the current status of the northern spotted owl, the environmental baseline for the action area, and the effects of the Project, the proposed action is not likely to jeopardize the continued existence of the northern spotted owl. Adverse action would occur to 49 acres of critical habitat.

The proposed action would not reduce the abundance or distribution of northern spotted owls within the Northern Oregon Coast physiographic province, and is not expected to significantly reduce the likelihood of both survival and recovery of the species. Spotted owls are not expected to permanently abandon the action area as a result of the noise disturbance that would be generated by the proposed action and a relatively small amount of habitat would be altered.

3.2.2 Compensatory Mitigation

Direct effects on the northern spotted owl are unlikely to occur as a result of the proposed action, however indirect effects are identified in Section 5.3.2 of the Applicant-Draft BA. The Coast Range habitat mitigation described in Section 6 and summarized in Table ES-3 would focus management for late-successional and old-growth forest, a limiting factor to the survival of the northern spotted owl.

3.2.2.1. Approach

Oregon LNG would take a programmatic approach to compensatory mitigation. A system for applying and crediting mitigation measures commensurate with impacts is detailed under Conservation Measures in Sections 5.3.1 and 5.3.2 of the Applicant-Draft BA. Details presented in the context of the assessment of impacts are discussed below.

3.2.2.2. Habitat Acquisition

Section 3 of the ESA defines “conservation” and includes habitat acquisition as one of the methods that may be used. In accordance with the definition of conservation, the Conservation Framework recommended habitat acquisition as a conservation measure to offset adverse effects of proposed removal of suitable habitat and other indirect effects. Thus, Oregon LNG proposes to provide habitat acquisition as a conservation measure for the northern spotted owl. The Conservation Framework devised a scale for categorizing (Low, Moderate, High, and Severe, defined in Table 3-1) the significance of impacts according to proximity to the northern spotted owl activity center, core, and quantity of NRF habitat subject for removal or other indirect effects. Habitat removal and other indirect effects would constitute an adverse effect subject to conservation measures. Mitigation ratios for habitat acquisition were established by USFWS in the Conservation Framework, ranging from 6:1 to 1.5:1, the former placing a premium on impacts to High NRF habitat in High Impact home ranges and the lower limit establishing a minimum no net loss objective for capable habitat in Low Impact home ranges or outside a home range.

The Conservation Framework allows for adjustments to habitat acquisition obligations based on a number of considerations, among them occupancy status and spatial elements (distance from nearest northern spotted owl home range and clustering patterns of northern spotted owl home ranges or High NRF/NRF patches). For example, as stated in Section 5.4.1.3 of the Conservation Framework, “The Service assumes that a Project-related activity that produces a High Impact Category disruption would result in the loss of a breeding season for a pair of NSO.” However, “loss of a breeding season for a pair of NSO” would depend on the presence of a breeding pair and there are none along the Pipeline. Thus, the Service’s assumption that a High Impact disruption would result in the loss of a breeding season for a pair of northern spotted owl is not valid for the Project. NRF habitat is limited and scattered across the landscape within the Pipeline action area, there are no occupied home ranges within the action area, and the land use is primarily industrial forest with limited likelihood of a trajectory for establishment of NRF habitat. Current and potential future ecological services that habitat proposed to be crossed by the Pipeline provides for the northern spotted owl justifies adjusting the amount of habitat acquisition based on the USFWS recommended ratios. Providing habitat acquisition recognizes the adverse effects on northern spotted owl habitat, despite their absence. Adjustments to the habitat acquisition obligation acknowledges the Project as an additional impact in a landscape where land management surrounding the Project is beyond the control of Oregon LNG and has a far greater effect on the recovery of the northern spotted owl than the Project itself.

According to the Conservation Framework, capable habitat in industrial forest would not be subject to mitigation. Area of removal during construction of the Pipeline subject to mitigation would amount to about 41.64 acres of NRF habitat, and 168.62 acres dispersal habitat (Table 3-2). No high-quality NRF would be affected. Since most of northwestern Oregon consists of industrial forest, there is a significant amount of capable habitat. However, the Conservation Framework recognizes that in the setting of industrial forestry, capable habitat is not likely to regrow to NRF habitat and is thus not be subject to mitigation. To put the magnitude of removal into perspective, there is approximately 644,000 acres of forest land in Clatsop (308,000 acres) and Columbia (336,000 acres) counties (OSU Extension Service, 2015a, 2015b). Permanent removal of approximately 210 acres of NRF and dispersal habitat would amount to 0.03 percent (three hundredths of one percent) of the total forest land in the two counties. The 210 acres is within the range of the year-to-year variability of timber harvest. Stated another way, 210 acres would be indistinguishable from the year-to-year fluctuations in timber harvest on the basis of board feet or area.

Table 3-2 summarizes the acres of habitat to be removed and resulting acquisition mitigation according to impact category and habitat type within critical habitat, spotted owl home ranges, and areas outside of home ranges and designated critical habitat. Capable habitat in the "low and outside" impact category is provided only as baseline information and, to be consistent with the Conservation Framework, is not included in mitigation calculations. The total amount of capable habitat impacted by habitat removal would be 475.21 acres, of which 3.44 acres not located on industrial forest land (capable habitat in the high and moderate impact category; see Table 3-2) would require mitigation under the Conservation Framework.

Table 3-3 summarizes the acres of habitat impacts as a result of other indirect effects and resulting acquisition mitigation according to impact category and habitat type within critical habitat, spotted owl home ranges, and areas outside of home ranges and designated critical habitat. The total capable habitat impacted by other indirect effects would be 3.15 acres, all of which would be mitigated under the Conservation Framework.

Table 3-4 summarizes adjusted mitigation for removal and other indirect effects, rounded to the nearest acre.

Conservation easements would be placed on land acquisitions to protect timberlands for suitable habitat for northern spotted owl and if within 52 miles of the coast, concurrently for the marbled murrelet. Written plans would be prepared that describe long-term prescriptions for management. Management plans may include prescriptions for planting, thinning, or other selective timber harvest that would place acquired habitat on a trajectory to becoming High NRF habitat.

Habitat acquisition would focus on the following priorities:

- Existing special and unique habitats, suitable or occupied threatened and endangered habitat, older forest structure, aquatic and riparian habitats, and designated critical habitat
- In-kind functional habitat that can be managed for late-successional habitat and conserved in perpetuity
- Existing high-quality habitat
- Sufficient acquisition commensurate with mitigation ratios
- Larger contiguous parcels adjacent to existing conservation areas
- Land capable of enhancing adjacent existing high-quality habitat
- Land capable of providing opportunities to enhance connectivity between existing high-quality habitats

Oregon LNG is exploring opportunities for acquiring land in the Coast Range. The Coast Range habitat mitigation described in Section 6 and summarized in Table ES-3 would focus management for late-successional and old-growth forest, a limiting factor to the survival of the northern spotted owl. Land acquisition would be finalized once FERC issues NGA Section 7(c) authorization for the Project.

The Conservation Framework (Section 5.4.1.1) "assumes acquisition of the same Habitat Categories as those that are impacted." However, the ability of the applicant to provide in-kind habitat acquisitions is dependent on the marketplace and availability and condition of land. Owners of timberland may be more willing to sell capable habitat rather than dispersal or NRF habitat with merchantable timber. As explained in the introductions to Sections 2.6 and 5.3, the Conservation Framework was prepared in the context of the proposed Jordan Cove Energy and Pacific Connector Gas Pipeline Projects, which cross 90 home ranges, a dozen or more of which are occupied (FERC, 2014) where in-kind habitat acquisitions would preserve the existing network of home ranges. The need for acquisitions to be in-kind might be more important where there is an immediate need to preserve an existing cluster of home ranges that support a viable regional population. In contrast, in Clatsop and Columbia counties, northern spotted owls, independent of the Pipeline, are on a collapsing trajectory as evidenced by few occupied home ranges clustered with spacing of ≤ 15 kilometers (9.3 miles) (Marcot et al., 2013). Furthermore, the amount of NRF habitat acquisition for this Project would not necessarily create, enhance, or connect northern spotted owl homes ranges, which is a goal of acquisition conservation. While the in-kind acquisition could be applied elsewhere in the Coast Range province where spotted owls exist in greater number than the north coast, such acquisition would have little benefit to the recovery of northern spotted owls in the subregion of the proposed impacts. In the context of the north Coast Range where the population of northern spotted owls is or has already collapsed, there could be a beneficial, long-term trade-off to acquiring out-of-kind habitat.

Capable, dispersal, NRF, and high NRF are not strictly defined by age of the trees. However, in the mostly industrial forest areas of the north Coast Range and the Pipeline route, forests are homogenous stands of even-aged trees. For a forest to achieve characteristics of dispersal habitat (minimally defined as 11 inches dbh, ≥ 40 percent canopy closure, and open space below the canopy) could take 20 to 30 years, depending on site capabilities and stand management. Stands less than 20 years would be capable habitat. Dispersal habitat would generally be two to three times older than the median age of capable stands. To achieve the complexity of NRF habitat could take 80 years of growth and active management or two to three times the age of a dispersal stand or 3 to 5 times the age of a capable stand. The amount of out-of-kind habitat acquisition would be based on the approximate ratio in ages between capable, dispersal, and NRF habitat. The rationale for the ratios is that more land would need to be acquired to account for temporal loss of habitat functions if higher-quality (older-aged stands) had to be replaced with lower-quality habitat (younger-aged stands). The reverse situation would be applied in the event that NRF habitat could be acquired to fulfill dispersal or capable habitat obligations. Supposing only capable habitat were available for acquisition, then Oregon LNG would acquire capable habitat at a 4:1 ratio for NRF habitat. Acquiring capable habitat for dispersal habitat would be done at a 2.5:1 ratio. Under this scenario, dispersal habitat would be fulfilled at a ratio of 1:2.5 (NRF:dispersal) and capable habitat would be fulfilled with NRF habitat at a ratio of 1:4 (NRF:capable). These scenarios are summarized in Table 3-5.

The worst-case scenario for out-of-kind land acquisition (i.e., most habitat acquired scenario) would result in the purchase of about 2,517 acres of capable habitat (based on the sum of the maximum out-of-kind NRF and dispersal acreage; see Table 3-5) or over 11 times the amount of indirect removal impacts of 213 acres.

Silviculture Treatments

> *"In certain circumstances, it may be appropriate to offset NSO habitat removal and other indirect adverse effects in Dispersal and Capable Habitat by use of silvicultural treatments in similar habitat to expedite the creation of NRF and High NRF Habitat. However, techniques to do so are still being developed and it is uncertain that silvicultural treatments can grow NRF or High NRF Habitats substantially faster than natural processes. The earliest age for habitat to be considered NRF is 80 years average stand age. Only about 2 percent of 80-year old stands have the characteristics of NRF habitat, though, and more typically a stand must be at least 100 years of age before it functions as NRF Habitat.*" (Conservation Framework, Section 5.4.1.2)

The Conservation Framework further suggests that "…silviculture is not appropriate mitigation for High NRF and NRF habitat impacts, where immediate, functional habitat offsets are necessary." For this Project, the Pipeline crosses only two unoccupied home ranges. Suitable habitat removal would be less than one percent of that needed to support a home range and would not significantly alter the current functional capabilities of the home ranges. Therefore, functional habitat offsets would not be necessary as an immediate necessity, making silvicultural treatments viable alternatives in planning conservation measures.

With silvicultural treatments, a significant time lag (decades to centuries) still occurs for younger stands (capable or young dispersal habitat) to mature and develop into functional suitable habitat. Silviculture is not appropriate mitigation for adversely impacted NRF habitat and would only be used to mitigate adverse impacts to capable or dispersal habitat. In circumstances where silviculture is an acceptable mitigation action, the mitigation ratios for adverse impacts to recruitment habitat using silvicultural treatment are higher than for capable habitat in recognition of uncertainties and temporal challenges.

For silvicultural treatments, mitigation ratios as shown in Table 3-6 (reprinted from Table 6 in the Conservation Framework) would be applied. These ratios would be applied on lands that are not directly acquired by Oregon LNG, but made available to the Project for the purpose of fulfilling its mitigation obligations. Oregon LNG would be responsible for the costs of silvicultural treatments, including preparation of management plans and costs associated with implementing the plan. Dispersement of proceeds or profits, if any, as a result of silvicultural treatment would be negotiated between the landowner and Oregon LNG.

Barred Owl Management

USFWS recognizes competition from the barred owl as a threat to the recovery of the northern spotted owl. Furthermore, USFWS is proposing to conduct experimental removal of barred owls as a method to aid in the recovery of the northern spotted owl. The Conservation Framework provides a rule set for financial support of the barred owl management program. However, the rule set applies to direct impacts on northern spotted owl home ranges and no northern spotted owl direct impacts are anticipated for the Project. Even though there are no direct impacts to northern spotted owl that would trigger compensatory mitigation via barred owl management funding, USFWS has stressed the importance and conservation priority of this conservation measures (Young/USFWS, 2014, personal communication). Therefore, in negotiations with the agency, USFWS proposed to develop a mix of compensatory northern spotted owl mitigation actions, including barred owl management funding, accepted in-lieu of habitat acquisition for up to 25 percent of the obligation for acquiring dispersal habitat[8]. The concept would result in the following formula: fee in-lieu = number of acres of dispersal habitat acquisition X 0.25 X market price for acquiring dispersal habitat. The obligation for acquiring dispersal habitat would then be reduced accordingly. For every $1,000,000 of estimated land acquisition, Oregon LNG could apply $250,000 to a fund that USFWS would use to support experimental projects in barred owl management. The Conservation Framework estimates a cost of $2,100 per home range per year for barred owl management. Thus, a contribution of $250,000 to the barred owl management program could provide treatment to 120 northern spotted owl home ranges for a year.

Other Considerations for Land Acquisition and Silvicultural Treatments

Additional requirements for conservation measures, particularly regarding habitat acquisition, would include preparation of conservation easements that would protect mitigation lands in perpetuity, preparation of management plans prescribing how land would be managed to create and maintain High NRF and NRF habitat, and creation of an endowment fund to support land management. Oregon LNG would fully fund these northern spotted owl habitat management planning and implementation actions, over life of Project's effects.

Enhancing the quality of habitat for northern spotted owls may not solely depend on habitat acquisition. Under very specific conditions, it may be appropriate to offset northern spotted owl habitat removal and other indirect adverse effects in recruitment and capable habitat by applying silvicultural treatments to capable or recruitment habitat. The ultimate goal of applying these silvicultural treatments is to expedite the development of and increase the amount, quality, and distribution of northern spotted owl dispersal and NRF habitat. While silvicultural treatments would likely be required on acquired land, they may also be applied to land owned by others (than Oregon LNG), such as a public entity or conservation organization who may not have the financial resources to support habitat enhancement. Management plans, to be funded by Oregon LNG, would be prepared regardless of land ownership for acquired lands or for lands where silvicultural treatments would be applied.

Management plans would address the following:

- If needed, prescriptions for planting (species and density of planting)
- Thinning that may be applied to enhance forest complexity

8 As discussed in a meeting between USFWS and CH2M HILL on October 30, 2014.

- Disposal of thinned trees (e.g., leaving them in the forest as downed logs; selling merchantable timber to pay for the cost of the management; or applying the sale of merchantable timber to an endowment fund for land management)
- Disposition of existing roads (e.g., ripping and replanting or maintaining them to allow access for forest management)
- Discussion of what existing or new roads may be needed for ongoing forest management or access for fire control
- Contingency process to address unforeseen disaster such as a wildfire
- Discussion of what recreational or hunting activities may be allowed on conserved land
- Description of conditions that may warrant some limited timber harvest in the future, proceeds of which could be used towards ongoing stewardship

Impacts to northern spotted owl habitat were based on landscape conditions interpreted from 2014 aerial photography. Habitat impacts and therefore habitat acquisition obligations are likely to change prior to commencement of construction as a result of ongoing timber harvest that is beyond the control of Oregon LNG. Final impacts to suitable habitat and resulting requirements for conservation measures would be reevaluated using aerial photography that is no more than 2 years older than the onset of construction (the earlier of the Terminal or Pipeline). Final impacts and conservation measures would ultimately be subject to review by the interagency Adaptive Management Team. The Services would retain their regulatory authorities under the ESA.

3.2.3 Contingency

Oregon LNG is not proposing compensatory mitigation for the northern spotted owl given the absence of known occupied sites in the action area. However, compensatory mitigation proposed for general habitat effects in the Coast Range (Section 6.0, see also Table ES-3) would be managed in consideration of the northern spotted owl, with a focus on late-successional and old-growth habitat. If future preconstruction surveys result in a detection within 1.5 miles of the Pipeline, a contingency plan would be implemented to prevent adverse effects. The USFWS would be immediately notified and consulted on elements necessary for contingency to prevent “take” or “harassment” and would consider the following general options:

- Construction deferment
- Habitat replacement via land acquisition
- Exploration of micro route change possibilities (as practicable)

3.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

Oregon LNG does not propose additional post-construction mitigation measures for northern spotted owls as operational activities are not expected to result in adverse effects on northern spotted owls. If unforeseen repairs necessitate activities within 1.5 miles of occupied habitat, USFWS would be notified and plans developed to implement necessary conservation measures.

Oregon LNG would monitor the results of northern spotted owl surveys on ODF lands, annually, through the time of construction. If a northern spotted owl is detected in or near the construction corridor before or during construction, then potential adaptive management may include determinations of potential effect significance; temporary suspension of construction activities in the immediate area until the end of the nesting season; or a minor reroute of the Pipeline. Additional terrestrial compensatory mitigation may need to be provided, depending on the severity of realized effects.

SECTION 4
Marbled Murrelet

Proposed mitigation measures for the marbled murrelet address Section 7(a)(1) of the Endangered Species Act, which directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of T&E species. Conservation recommendations are discretionary agency activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, enhance the effectiveness of recovery plans, or provide information on the species.

The conservation strategy for the marbled murrelet is described in the USFWS *Recovery Plan for the Threatened Marbled Murrelet* (*Brachyramphus marmoratus*) *in Washington, Oregon, and California* (Recovery Plan) (USFWS, 1997**).** The Recovery Plan recommends that efforts concentrate on maintaining occupied sites, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new habitat. The Recovery Plan further recommends that efforts be directed at the conservation of suitable and occupied murrelet nesting habitat in the Elliott State Forest, Tillamook State Forest, and Siuslaw National Forest to help restore the north-south distribution of murrelet populations and suitable habitat in Zone 3 (USFWS, 1997).

Potential effects of actions related to the Project are addressed in Appendix 15 of the Applicant-Draft BA. The Recovery Plan lists six Conservation Zones for the marbled murrelet. The Project is located in Zone 3, which spans the Oregon Coast from the Columbia River in the north to North Bend, Coos County in the south. The land has been actively managed for timber production over the past century. Much of the habitat on nonfederal land is of lesser quality because it occurs in smaller, more fragmented blocks. In addition to timber production, forests in the Oregon Coast Range have been fragmented by several recurrent catastrophic windstorms and high-severity burns, both natural and human caused. The action area for the Pipeline contains little high-quality murrelet nesting habitat relative to federal lands in Zone 3.

The action area of the Pipeline intersects one murrelet critical habitat unit (CHU OR-01-d) in eight distinct areas, roughly from MP 34 to MP 42 (TEC and CH2M HILL, 2015; see Appendix 13 [Northern Spotted Owl and Marbled Murrelet Habitat Assessments and Survey Reports] to the Applicant-Draft BA). Most of the land in the action area and within the CHU is owned by ODF, and a small portion is under private ownership. Most of the forested areas within the action area and the CHU have been harvested for timber within the last 60 years, according to estimated stand age data provided by ODF. The Project area contains PCEs of marbled murrelet critical habitat within the CHU. In 2008, Oregon LNG conducted a habitat assessment to identify potentially suitable habitat for the marbled murrelet within 1.5 miles of the Pipeline (see *Habitat Assessment—Potential Northern Spotted Owl and Marbled Murrelet Habitat on Lands Adjacent to the Oregon LNG Pipeline* and Applicant-Draft BA Appendix 13) within Clatsop, Columbia, Tillamook, and Washington counties in Oregon. The methods used were the same as those described above for northern spotted owl. In 2012, Oregon LNG assessed the availability of suitable marbled murrelets habitat within 1.5 miles of the Pipeline in Columbia County, Oregon (see *Northern Spotted Owl and Marbled Murrelet Habitat Assessment for Oregon LNG Reroute* in Applicant-Draft BA Appendix 13).

Protocol marbled murrelet surveys were conducted from 2008 to 2009 and from 2012 to 2013. Oregon LNG completed 69 marbled murrelet surveys during the first 2-year protocol period (2008-2009) survey period (see the 2009 *Final Report for Oregon LNG Northern Spotted Owl and Marbled Murrelet Surveys* in Applicant-Draft BA Appendix 13) and 50 marbled murrelet surveys during the 2012-2013 protocol surveys (see *Oregon LNG Project Survey Report 2013 Marbled Murrelet and Northern Spotted Owl* in Applicant-Draft BA Appendix 13). The surveys were conducted on 17 sites[9] at a total of 22 survey stations. During fieldwork conducted in 2008 and 2009, Oregon LNG observed a single marbled murrelet high above the forest canopy indicating non-nesting behavior within the survey area, but revealing that marbled murrelets use the area to migrate to nesting and foraging

9 As a result of changes in the Project design, the first 2-year protocol survey period was initiated in 2007 and the second was initiated in 2012. Restricted access on private land limited the ability of Oregon LNG to survey some areas with suitable habitat for marbled murrelet.

habitat. Otherwise, none of the possible habitat delineated from habitat modeling was occupied in the survey area in 2008 and 2009. No murrelets were observed during the 2012 to 2014 surveys.

4.1 Onsite Mitigation

Oregon LNG identified eight suitable habitat units (SHUs) for marbled murrelets within 0.25 mile of the Oregon LNG Project (Table 4-1). Six of the eight SHUs were surveyed to protocol for at least two consecutive years between 2009 and 2014 with probable absence (TEC, 2009, 2013, 2014; updated BA Appendix 13). The remaining two SHUs were not surveyed due to access restrictions and are assumed occupied.

Fieldwork conducted in 2008, 2009, 2012, and 2014 can be summarized as follows:

- Two years of protocol surveys for marbled murrelets were completed in 2009. One visual observation of a marbled murrelet well above canopy height in 2008 indicated non-nesting behavior near the Pipeline corridor.
- Two years of protocol surveys for marbled murrelets were completed in 2014. No marbled murrelets were detected during the 2012 to 2014 surveys. Two areas of suitable habitat could not be surveyed due to access restrictions and are assumed to be occupied. When access to property is obtained, surveys would be conducted for marbled murrelets in suitable habitats within the action area where current survey data are deficient. This would aid in documenting marbled murrelet inland ranges and habitat use.

The Pipeline route avoids areas of suitable marbled murrelet habitat and designated critical habitat to the greatest extent practicable. Oregon LNG recommendations are to avoid, minimize, or restore unavoidable adverse effects and as well as promote the recovery of marbled murrelets with the following measures:

- Reduce the width of the construction corridor to 75 feet where PCE1 trees are located in the CHU.
- Survey for murrelets in suitable habitats within the action area where current survey data are deficient. This would aid in documenting murrelet inland ranges and habitat use.
- Avoid construction activities within 0.25 milesof occupied and assumed occupied sites during the critical breeding period (April 1 to August 5), except for the transportation of heavy equipment on high-use roads. Construction activities which occur during the late breeding period and within the disturbance distance (0.25 miles) but greater than 100 yards from occupied sites would adhere to daily dawn-to-dusk timing restrictions, where construction activities would begin precisely 2 hours after sunrise and end 2 hours before sunset.
- Avoid removal of occupied and assumed occupied suitable nesting habitat during the entire nesting period (April 1 through September 15).
- Avoid construction activities within 100 yards of occupied and assumed occupied sites during the entire breeding period (April 1 to September 15), except for the transportation of heavy equipment on high-use roads.
- Avoid construction activities within 0.25 miles of occupied and assumed occupied sites during the critical breeding period (April 1 to August 5), except for the transportation of heavy equipment on high-use roads. Construction activities which occur during the late breeding period and within the disturbance distance (0.25 miles) but greater than 100 yards from occupied sites would adhere to daily dawn-to-dusk timing restrictions, where construction activities would begin precisely 2 hours after sunrise and end 2 hours before sunset.
- Minimize clearing and construction for new access roads to reduce removal of potential recruitment or suitable habitat and creation of new forest edges.
- Transport heavy equipment on high-use roads during the critical and late breeding periods with adherence to daily timing restrictions (dusk to dawn-2 hours after sunrise and ending 2 hours before sunset).
- Minimize clearing Douglas-fir, Sitka spruce, western hemlock, or western red-cedar trees that have potential nesting platforms within the designated CHU, to the greatest extent possible. Maintaining these structures would accelerate the recruitment of suitable habitat within the unit. Oregon LNG would reduce the width of the construction corridor to 75 feet where PCE1 trees are located in the CHU.

- Restrict the use of heavy equipment, helicopters,[10] and chainsaws within 0.25 mile of any known or assumed occupied nest site during the daily peak activity periods (from 2 hours before official sunrise to 2 hours before official sunset).
- Implement a lighting plan at the Terminal that incorporates the following elements: (a) directional lighting facing onshore to the extent possible, (b) screens or lighting hoods, (c) motion-activated lighting, (d) full-cutoff light fixtures, which have no direct uplight, help eliminate glare, and are more efficient by directing all lighting down to the intended area only, and (e) strobing lights to the greatest extent practicable.
- Send results of survey efforts to USFWS on an annual basis, in order to maintain and update baseline information. Oregon LNG would provide USFWS with the results of 2 years of protocol surveys as they become available.
- To the greatest practicable extent, maximize use of vibratory hammers and minimize impact hammers for pile driving to minimize underwater noise.
- Use pile caps and bubble curtains to minimize underwater noise from pile driving.
- Although blasting is not a proposed action, if it were to occur within a mile of suitable habitat, BMPs would include avoidance of such action during the critical breeding season (April 1 to August 5); minimizing the quantity of charges to the least amount required; and use of blasting mats, sand, or crushed rock to reduce sound generation.

The Recovery Plan (USFWS, 1997) recommended that restoration efforts concentrate on maintaining occupied sites, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new habitat. Oregon LNG has demonstrated its commitment to these recovery goals by avoiding occupied sites and minimizing the loss of unoccupied but suitable habitat. During 2012, Oregon LNG had a multidisciplinary team consisting of marbled murrelet biologists and geotechnical engineers redesign the route through Columbia County to avoid mature forest stands, including stands with suitable murrelet nesting structure. The Recovery Plan further recommended that efforts be directed at the conservation of suitable and occupied marbled murrelet nesting habitat in the Elliott State Forest, Tillamook State Forest, and Siuslaw National Forest to help restore the north-south distribution of marbled murrelet populations and suitable habitat in Zone 3 (TEC, 2008; USFWS, 1997). Oregon LNG is proposing to provide habitat mitigation in accordance with the Conservation Framework.

4.2 Effects and Compensatory Mitigation

There is a low likelihood that direct take of nesting marbled murrelets would occur, because although the species was not documented within 0.25 mile of the Project during 4 years of protocol surveys, two areas of suitable habitat could not be surveyed due to access restrictions and are assumed to be occupied by the species.

Compensatory mitigation for effects on CHU habitat would be stacked in association with compensatory mitigation for Northern spotted owl and ODFW habitat mitigationhabitat, to the extent that such mitigation occurrs within 52 miles of the coast.

To offset unavoidable adverse effects, and to mitigate for temporal effects from Pipeline clearing in designated critical habitat and suitable marbled murrelets nesting habitat, Oregon LNG proposes to acquire land for securing conservation easements. This approach is also intended to offset unavoidable and temporal effects related to upland and riparian resources in the Coast Range and benefit compensatory objectives. Habitat acquisition would be in locations that can be managed and preserved for old-growth habitat.

The Project actions are not expected to significantly reduce the likelihood of survival and recovery of the species. General construction disturbance of marbled murrelets may affect their behavior, but there is a low likelihood of ‘take’ of any individuals. Construction activities would occur outside the critical nesting period of any known or assumed occupied marbled murrelet habitat. Oregon LNG identified eight areas of suitable marbled murrelet

[10] Type 1 helicopter use can affect murrelets for up to 0.5 mile. Type I helicopters seat at least 16 people and have a minimum capacity of 5,000 pounds. Both a CH-47 (Chinook) and UH-60 (Blackhawk) are Type I helicopters. All other helicopters have 0.25-mile disturbance.

habitat within the action area, which are distributed sporadically along approximately half of the Pipeline (*Oregon LNG Project Survey Report 2013—Marbled Murrelet and Northern Spotted Owl* [TEC, 2013; Applicant-Draft BA Appendix 13]). Seven of the eight marbled murrelet SHUs within the Pipeline easement are located between MP 30 and MP 46.

The proposed action would remove approximately 40 acres of designated critical habitat within the Pipeline construction right-of-way, including temporary and ATWS.

The area of the proposed construction right-of-way located within the CHU contains only one of the PCEs of marbled murrelet critical habitat. No trees with potential nesting platforms, the requirement for PCE1, would be removed or modified.

To offset unavoidable adverse effects, and to mitigate for temporal effects from Pipeline clearing in designated critical habitat and suitable marbled murrelets nesting habitat, Oregon LNG proposes to provide habitat acquisition as a conservation measure for marbled murrelet. The Conservation Framework devised a scale for categorizing the significance (Low, Moderate, High, and Severe, defined in Table 4-2) of impacts according to the type of habitat that would be affected and its proximity to suitable habitat. Removal and other indirect effects would constitute an adverse effect subject to habitat acquisition as a conservation measure. Mitigation ratios for habitat acquisition were established by USFWS in the Conservation Framework, ranging from 8:1 to 1.5:1, the former placing a premium on impacts to High suitable habitat and the lower limit establishing a minimum no net loss objective for capable habitat in Low Impact units or outside SHUs. As a result of the specific importance of suitable nesting trees, loss of individual trees suitable for nesting by the species is mitigated at a higher ratio.

The Conservation Framework allows for adjustments to be made to habitat acquisition obligations based on a number of considerations, among them stand occupancy or status, acreage of suitable habitat to be removed, critical habitat designation, biological viability of any habitat fragments created, proximity to the marine environment, and unique Project attributes per agreement with the Service. As a result of operations on industrial forests, current and potential future ecological services that habitat proposed to be crossed by the Pipeline provides for the marbled murrelet justifies adjusting the amount of habitat acquisition based on the USFWS recommended ratios. Providing habitat acquisition recognizes the potential adverse effects on marbled murrelet, despite their absence. Adjustments to the habitat acquisition obligation acknowledge the Project as an additive impact in a landscape where land management surrounding the Project is beyond the control of Oregon LNG and has a far greater effect on the recovery of the marbled murrelet than the Project itself.

Table 4-3 summarizes the acres of habitat to be removed and resulting acquisition mitigation according to impact category and habitat type within critical habitat and areas outside of critical habitat.

Table 4-4 summarizes the acres of other indirect impacts and resulting acquisition mitigation according to impact category and habitat type within critical habitat and areas outside of critical habitat.

Table 4-5 summarizes adjusted area of habitat acquisition for removal and other indirect effects.

The Conservation Framework calls for in-kind (according to stand age) habitat acquisitions. However, the ability of the applicant to provide in-kind habitat acquisitions is dependent on the marketplace, availability of willing sellers, and condition of land. Owners of timberland may be more willing to sell clear-cut or recently clear-cut or recently-cut land (i.e., capable habitat) than land with merchantable timber in age classes greater than 60 years (recruitment or suitable habitat age classes). Supposing only capable habitat were available for acquisition, then Oregon LNG would acquire capable habitat at a 5:1 ratio for suitable habitat. Acquiring capable habitat for recruitment habitat would be done at a 3.5:1 ratio. These ratios would be applied to the acres in Table 4-5. The rationale for the ratios is that more land would need to be acquired to account for temporal loss of habitat functions if higher quality (older aged stands) had to be replaced with lower quality habitat (younger aged stands). The reverse situation would be applied in the event that suitable habitat could be acquired to fulfill recruitment or suitable capable habitat obligations. Under this scenario, recruitment habitat would be fulfilled at a ratio of 1:1.5 (suitable: recruitment) and capable habitat would be fulfilled with suitable habitat at a ratio of 1:5 (suitable:capable). These scenarios are summarized in Table 4-6.

Forest land acquired for conservation would continue to naturally mature and either gain or maintain the characteristics of suitable murrelet habitat over a 100-year period, or the lifetime of the Project. This assumes that potential nesting structure would develop within an acquired conservation area roughly 90 years after the last stand-replacing event or that western hemlock mistletoe brooms are present to provide nesting structure as soon as 60 years. In theory, a young, capable (10-year-old) forest stand would become recruitment habitat about 50 years after acquisition and develop suitable murrelet nesting platforms about 70 to 80 years after acquisition. Likewise, a mature stand (60-year-old) would likely serve as suitable habitat as soon as 20 years after acquisition. Out-of-kind habitat acquisition ratios are based on the relationships between estimated years from current stand status to future ecological function as suitable murrelet habitat over the next 100 years:

- Capable = 20 years of suitable habitat function
- Recruitment = 70 years of suitable habitat function
- Suitable = 100 years of suitable habitat function

Conservation easements would be placed on land acquisitions to protect timberlands for suitable habitat for land acquired within 52 miles of the coast. Since both the marbled murrelet and northern spotted owl are dependent on older forests, habitat acquisition suitable for marbled murrelet would also provide functional mitigation for the northern spotted owl. Habitat acquisitions could be used to satisfy conservation meausres for the two species, simultaneously. Written plans would be prepared that describe long-term prescriptions for management.

Management plans would include prescriptions for planting, thinning, or other selective timber harvest that would place acquired habitat on a trajectory to becoming suitable habitat:

- If needed, prescriptions for planting (species and density of planting)
- Thinning that may be applied to enhance forest complexity
- Disposal of thinned trees (e.g., leaving them in the forest as downed logs; selling merchantable timber to pay for the cost of the management; or applying the sale of merchantable timber to an endowment fund for land management)
- Disposition of existing roads (e.g., ripping and replanting or maintaining them to allow access for forest management)
- Discussion of what existing or new roads may be needed for ongoing forest management or access for fire control
- Contingency process to address unforeseen disaster such as a wildfire
- Discussion of what recreational or hunting activities may be allowed on conserved land
- Description of conditions that may warrant some limited timber harvest in the future, proceeds of which could be used towards ongoing stewardship

Habitat acquisition would focus on the following priorities:

- Existing special and unique habitats, suitable or occupied threatened and endangered habitat, older forest structure, aquatic and riparian habitats, and designated critical habitat
- High-quality functional habitat that can be managed for late-successional habitat and conserved in perpetuity
- Existing high-quality habitat
- Sufficient acquisition commensurate with mitigation ratios
- Larger contiguous parcels adjacent to existing conservation areas, SHUs, and designated critical habitat
- Land capable of enhancing adjacent existing high-quality habitat
- Land capable of providing opportunities to enhance connectivity between existing high-quality habitats

- Land capable of simultaneously providing functional habitat for the northern spotted owl

Oregon LNG is exploring opportunities for acquiring land in the Coast Range. Land acquisition would be finalized once FERC issues NGA Section 7(c) authorization for the Project.

Additional requirements for conservation measures, particularly regarding habitat acquisition, would include preparation of conservation easements that would protect mitigation lands in perpetuity, preparation of management plans prescribing how land would be managed to create and maintain suitable nesting habitat, and creation of an endowment fund to support land management. Oregon LNG would fully fund these marbled murrelet habitat management planning and implementation actions. Investment in the endowment fund (amount to be determined in coordination with the Adaptive Management Team) would occur over the first 10 years of the Project. Upon full investment, the endowment fund would support land management over the life of the Project's effects.

Enhancing the quality of habitat for marbled murrelets may not solely depend on habitat acquisition. Under specific conditions, it may be appropriate to offset marbled murrelet habitat removal and other indirect adverse effects in recruitment and capable habitat by applying silvicultural treatments to capable or recruitment habitat. The ultimate goal of applying these silvicultural treatments is to expedite the development of and increase the amount, quality, and distribution of marbled murrelet suitable habitat. While silvicultural treatments would likely be required on acquired land, they may also be applied to land owned by others (than Oregon LNG), such as a public entity or conservation organization who may not have the financial resources to support habitat enhancement.

With silvicultural treatments, there still is a significant time lag (decades to centuries) for younger stands (capable or recruitment habitat) to mature and develop into functional suitable habitat. Therefore, silviculture is not appropriate mitigation for adversely impacted suitable habitat and would only be used to mitigate adverse impacts to capable or recruitment habitat. In circumstances where silviculture is an acceptable mitigation action, the mitigation ratios for adverse impacts to recruitment habitat using silvicultural treatment are higher than for capable habitat in recognition of uncertainties and temporal challenges.

For silvicultural treatments, mitigation ratios and the amount of land on which treatments are applied would follow the ratios in Table 4-7 for recruitment habitat types.

Impacts to marbled murrelet habitat were based on landscape conditions interpreted from 2014 aerial photography and ground-truthed during protocol surveys. Habitat impacts and therefore habitat acquisition obligations are likely to change prior to commencement of construction as a result of ongoing timber harvest that is beyond the control of Oregon LNG. Final impacts to suitable, recruitment, and capable habitat and resulting requirements for conservation measures are subject to change and would be reevaluated using aerial photography that is no more than 2 years older than the onset of construction (the earlier of the Terminal or Pipeline). Final impacts and conservation measures would be subject to review and approval by the interagency Adaptive Management Team. The Services would retain their regulatory authorities under the ESA.

SECTION 5

Fish

Fish species and their habitat that would potentially be affected by the Project are addressed in Section 3.1 of Resource Report 3 and Sections 3.1 to 3.9 of the Applicant-Draft BA. Effects and measures to mitigate them are addressed in Section 3.5.1 and Appendix 3B (Aquatic Survey Reports) of Resource Report 3, and Applicant-Draft BA Appendix 15 (*Summary of Potential Effects and Mitigation Measures for Protected [ESA, MBTA, MMPA] and Sensitive Habitats Associated with the Oregon LNG Bidirectional Project*). They are analyzed in greater detail and discussed further in Sections 3.4 (Terminal Effects and Conservation Measures) and 3.5 (Pipeline Effects and Conservation Measures) of the Applicant-Draft BA.

Section 5.1 addresses Project effects on fish and describes the onsite mitigation measures (avoidance, minimization, and conservation) that would be used to either eliminate or reduce those effects. Section 5.2 outlines a compensatory mitigation plan that has been designed to more than compensate for both direct and indirect effects on fish and their habitat that are unavoidable or cannot be reduced to insignificant levels through the avoidance, minimization, and conservation measures described in Section 5.1. The mitigation plan focuses on effects on listed species of fish and their habitat, but would also mitigate for effects on nonlisted species and their habitat.

5.1 Onsite Mitigation, Avoidance, and Minimization Measures

As stated in the section above, Applicant-Draft BA Appendix 15 consists of a table that summarizes measures taken to avoid and minimize effects on fish. The table reviews measures associated with the Pipeline and Terminal. The sections that follow provides additional details and descriptions. Avoidance and minimization measures summarized in Appendix 15 are applicable to actions in Section 8, Stream Channels and Waterbodies, later in this report.

5.1.1 Pipeline

The onsite avoidance, minimization, and conservation measures for potential Pipeline effects on individual ESA-listed fish, critical habitat, existing conditions, and fish not related to critical habit are based on effects summarized in Tables 3.8-4 through 3.8-20 of the Applicant-Draft BA.

Negative effects on ESA-listed salmonids expected to result as a consequence of Pipeline construction would be primarily short term during active construction. The most significant of these negative effects include effects on individual salmonids resulting from fish salvage and increased turbidity downstream of flume and open-cut stream crossings. To avoid negative effects on ESA-listed salmonids, horizontal directional drilling (HDD) methods would be implemented so that construction and installation of the Pipeline would be below the bottom of the streambed, preventing disturbance to channel geometry, habitat features, aquatic and riparian species, and water quality at 13 locations(Table 5-1).

There are a limited number of flume crossings where salvage and turbidity increases would affect listed Evolutionarily Significant Units (ESUs), and any one ESU is not affected by more than eight such crossings. Implementation of the conservation measures described below would minimize the negative effects on individual fish and should limit “take” primarily to harassment and short-term behavioral effects. As discussed in Section 5.2, a very small number of fish potentially could suffer mortality during the salvage operations. Changes to instream habitat are expected to be mitigated by the proposed conservation measures described below.

Longer-term effects would include a small loss of shade at each crossing for several years post-construction and a minor loss of large woody debris (LWD) recruitment potential. The shade lost is not expected to raise stream temperatures (CH2MHILL, 2009). Loss of LWD recruitment would be mitigated by placing LWD as appropriate, by rehabilitating riparian areas and as would be discussed in Section 5.2 through offsite long-term protection of mature, high-quality riparian habitat. Taken as a whole, the Project would have limited negative effects that largely would be offset by the proposed conservation measures.

5.1.1.1. Fish Salvage

Fish within the construction zone at each flumed Pipeline crossing would be removed before construction following a detailed fish salvage plan. This plan has been developed and was originally presented in Resource Report 3, Appendix 3B, as the *Oregon LNG Pipeline Waterbody Crossing: Fish Salvage Plan* technical memorandum, filed with FERC by Oregon LNG in October 2008, and revised and resubmitted as Appendix 3O on June 7, 2013 (see Appendix 2C to the Applicant-Draft BA for the 2013 plan). Before fish salvage activities are conducted, an ODFW/NMFS Scientific Taking Permit would be obtained for species that may be encountered at any of the crossing areas, including species listed under the federal ESA.

Fish species likely to be encountered during fish salvage activities include salmonids (salmon and trout), cyprinids (minnows), cottids (sculpins), gasterosteids (sticklebacks), petromyzontids (lampreys), catostomids (suckers), ictalurids (catfish), and centrarchids (sunfish and bass). A detailed list of fish species likely to be encountered at Pipeline stream crossings is available in Section 3.1 of Resource Report 3.

Crossing methods that involve in-water or in-channel work would be constructed during the designated ODFW In-water Work Window (ODFW, 2008) unless specifically authorized in writing by ODFW. In-water work window guidelines minimize potential adverse effects on fish and wildlife and their habitats. They also usually avoid sensitive life stages, including spawning, rearing, and migration.

A qualified fisheries biologist would be onsite to oversee and conduct fish salvage operations. Appropriate fish handling permits would be obtained from ODFW and NMFS before fish salvage begins, and collected fish would be relocated immediately to an appropriate area within the same stream. Because lampreys may be present at waterbody crossings, special salvage procedures have been incorporated into this fish salvage plan to account for the capture of lamprey ammocoetes or other larval stages (see 2(i) below).

Fish would be salvaged using backpack electrofishing equipment, traps, seines, or other approved methods. If electrofishing equipment is to be used and potential ESA species may be present, NMFS electrofishing guidelines would be followed (NMFS, 2000). Electrofishing is the most appropriate method for capturing lamprey ammocoetes (larvae) during salvage activities. Traps can be used, but they typically capture lampreys as they migrate upstream or downstream.

Additionally, any fish that are captured would be handled according to requirements in the Scientific Taking Permit and which involve the following standards:

- Before and intermittently during isolation of the in-water work area, capture fish trapped in the area by using a trap, seine, electrofishing, or other methods as are prudent to minimize risk of injury, then release them at a safe release site.
- Do not use electrofishing if water temperatures exceed 18 degrees Celsius (°C) or are expected to rise above 18°C, unless no other method of capture is available.
- Take fish by backpack electrofishing, seining, or other approved method. If electrofishing equipment is used to capture fish, comply with NMFS electrofishing guidelines (NMFS, 2000).
- Handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.
- Ensure that water quality conditions are adequate in buckets or tanks used to transport fish by providing circulation of clean, cold water; using aerators to provide dissolved oxygen; and minimizing holding times.
- Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.
- Do not transfer ESA-listed fish to anyone except NMFS personnel, unless otherwise approved in writing by NMFS.
- Allow NMFS or its designated representative to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities. Submit an electronic copy of the Salvage Report Form to NMFS within 10 calendar days of completion of the salvage operation.

- Rescue/salvage (take) of fish during isolation of in-water work areas at Pipeline waterbody crossings would include handling of adults or juveniles. Fish handled must be recorded in the annual report for the Scientific Taking Permit.
- In-water work (fish salvage or construction) may occur between the specific designated in-water work windows for each specific waterbody. Exceptions to these in-water work periods must be approved by the local ODFW District Fish Biologist or his/her representative and submitted to the ODFW ESA Program Specialist, in writing, before work commences outside the approved in-water work windows.
- Activities must be coordinated with the local ODFW District Fish Biologist before any sampling.
- Indirect mortality may not exceed 10 percent of the total take, or—for species listed under the federal ESA—up to a specified number of individuals. In the event that mortality for any species exceeds the specified rate, the permittee would contact the ESA Program Specialist, ODFW, before any further activity.

The ODFW in-water work windows for waterbodies to be crossed by the Pipeline are provided in Attachment 1 of the *Oregon LNG Pipeline Waterbody Crossing: Fish Salvage Plan* technical memorandum originally submitted to FERC in 2008, and revised and resubmitted in June 2013 as Resource Report 3, Appendix 3O (see Appendix 2C of the Applicant-Draft BA for the June resubmittal version).

The following general procedures and steps would be conducted during salvage activities at crossing sites:

1. Set block nets upstream and downstream of the area to be crossed to ensure that fish or lampreys cannot enter the construction area.
2. Conduct the salvage between the block nets by using electrofishing equipment, seine, trap, or other approved method. If using electrofishing equipment, a minimum two-pass method would be employed to ensure that fish and lampreys are captured. Electrofishing equipment is the most appropriate method for capturing larval lamprey during salvage activities at crossing sites.
    a. The first electrofishing pass of the minimum two-pass method would be specifically for capturing larval lamprey. The electrofishing unit would be set to deliver three pulses/second (125 volts direct current [dc]) at 25 percent duty cycle, with a 3:1 burst pulse train (three pulses on, one pulse off) to remove larvae from the substrate (USFWS, 2002). Once larvae emerge, 30 pulses/second would be applied to stun the larvae.
    b. The second and subsequent electrofishing passes would be to capture fish that may be in the area and were not captured during the first electrofishing pass. The electrofishing unit would be set accordingly to deliver the appropriate pulse rate/second at the appropriate voltage and duty cycle based in part on fish size, streamflow, velocity, depth, temperature, and conductivity.
3. Captured fish and lampreys would be handled to the minimal extent possible and placed in containers of clean, aerated water. Individuals would be held in containers for the minimal time necessary. Captured individuals would be enumerated, identified, and noted in a field logbook before being released. Captured individuals would be released into a safe site as quickly as possible, and as near as possible to capture sites.
4. After lampreys and other fish have been captured in the construction area, install the flume or dam-and-pump equipment.
5. Inspect the isolated area for stranded fish and salvage, if necessary.
6. Construct crossing, restore waterbody channel, and remove flume equipment to restore flow in the construction area per the guidelines below:
    a. When downstream siltation must be avoided, flumes are generally not recommended for use where waterbodies have a broad unconfined channel, permeable substrate, excessive discharge, or where a significant amount of bed or bank alteration is required to install flumes or dams.
    b. Schedule crossing during low-flow period, if possible.

c. Complete watercourse activities as expediently as possible. In accordance with FERC procedures, the duration of construction would be limited to 24 hours across minor waterbodies (10 feet wide or less) and 48 hours across intermediate waterbodies (between 10 and 100 feet wide).

d. Do not refuel mobile equipment within 150 feet of a waterbody. Refuel stationary equipment per the SWPPP submitted to FERC in June 2013 (see Appendix B).

e. Minimize riparian clearing to accommodate stream size, terrain, and existing vegetation conditions, and to avoid removal of significant trees, where possible, at the margins of the temporary construction zone. Existing LWD would be salvaged for reinstallation, and a sufficient quantity of large-diameter conifer logs would be stockpiled for post-construction aquatic habitat enhancement.

f. Install temporary equipment crossing.

g. In agricultural land, strip topsoil from spoil storage area.

h. Instream spoil to be stored on banks a minimum of 150 feet from the top of bank for perennial streams.

i. Leave hard plugs at the stream bank edge until just before pipe installation.

j. Size flume to handle 150 percent of the anticipated flows. Install flume in watercourse and maintain correct alignment until removed.

k. Construct upstream dam followed by downstream dam. Install a flange on upstream end of flume and seal to substrate with sandbags and polyethylene liner where necessary to ensure a watertight barrier. “Key” dams into banks or construct secondary dam, if necessary.

l. Pump stream channel between dams, if necessary. Discharge water through a dewatering structure and onto a stable, well-vegetated area to prevent erosion and sedimentation. No heavily silt-laden water may be discharged in the stream.

m. Construct sediment barriers (straw bales and/or silt fence) to prevent silt-laden water and spoil from flowing back into the watercourse. Constructed sediment barriers shall extend along the sides of the stockpiles and the ends of dams. Barriers may be temporarily removed to allow construction activities but must be replaced by the end of each work day.

n. Complete prefabrication of instream pipe section and weight pipe as necessary before commencement of instream activity.

o. Trench through watercourse. Install temporary (soft) plugs, if necessary, to control water flow and trench sloughing.

p. Maintain streamflow, if present, through flume throughout crossing construction.

q. Lower-in pipe, install trench plug, and backfill immediately.

r. Backfill with native material.

s. Restore watercourse channel to approximate preconstruction profile and substrate.

t. Restore stream banks to approximate original condition and stabilize, as required.

Restoration and cleanup would begin after the trench is backfilled or as soon as weather and site conditions permit, and in accordance with landowner requests, the FERC Plan, and as described in Resource Report 2, Appendix 2D. These fish salvage procedures would be followed at the Pipeline crossings requiring fish salvage. A field log would be kept for each fish salvage operation that documents the number of fish by species and age group (adult or juvenile), disposition of released fish noting any injuries or mortalities, date, salvage team members, and general observations. After stream crossings and salvages have been completed, a report would be compiled that summarizes the number of fish salvaged by species and their disposition.

Rivers and streams that are known to support anadromous salmonids in the Northern Oregon Coastal and Willamette basins, and would be crossed using flume and open-cut crossing methods, are listed in Appendix C

(*Characteristics of Streams Crossed by the Pipeline*). Those listed as open-cut crossings are assumed to be dry during the in-water work window. Streams that contain water during Pipeline construction would be crossed using the flume method.

Many perennial named and unnamed streams that the Pipeline would cross are likely to support resident coastal cutthroat trout or nongame fish species such as sculpin. Perennial streams are assumed to support fish and would require fish salvage at the crossing site.

5.1.1.2. Physical Instream Habitat Alteration

Physical instream habitat alteration would be avoided to the extent possible through conscientious Pipeline siting and the judicious use of HDD methods. The techniques discussed below would be employed to restore and minimize effects on instream habitat at flumed Pipeline crossings. Stream habitat would be restored, as closely as possible, to preconstruction condition by using appropriate available technologies. Native materials (including large wood, native vegetation, weed-free topsoil, and native channel materials [gravel, cobble, and boulders]) disturbed during site preparation would be conserved onsite for site restoration. The following actions would be taken to preserve and replace native materials and to restore the morphology of the stream:

- Locations of instream habitat features would be photo-documented before construction.
- If possible, native materials would be undisturbed. Where stream bank areas require clearing, vegetation would be clipped at ground level to retain root mass and encourage reestablishment of native vegetation.
- During removal, streambed material would be segregated according to vertical horizons and backfill would occur in reverse order. Native materials that are moved, damaged, or destroyed would be replaced with a functional equivalent during site restoration.
- LWD taken from below the Ordinary High Water Line and within 150 feet of a stream—along with native vegetation, weed-free topsoil, and native channel material displaced by construction—would be retained for use during site restoration.
- As part of the site restoration, LWD taken from the riparian zone or stream during construction would be returned to those areas and placed in a natural configuration.
- The waterbody would be restored to its preconstruction contours by using native materials augmented by functionally equivalent fill.

Stream bank erosion would be minimized by clearing the smallest amount of vegetation possible at stream crossings and grubbing only over the ditch line. Rootstocks would be left in place for erosion control and rapid post-construction vegetative regeneration, in addition to seeding and mulching, planting native vegetation (where necessary), and—in some cases—use of biodegradable erosion control fabrics.

Stream crossings would be conducted in compliance with the FERC Plan and Procedures for Pipeline stream crossings. They would be monitored after construction to ensure that bank stabilization methods employed were effective in abating increased sedimentation. Immediately after pipe installation and backfilling, and before the dams and flumes are removed and flow is returned to the waterbody channel, the stream banks would be reestablished to approximate preconstruction contours and stabilized. Erosion and sediment control measures would be installed across the construction easement to reduce stream bank and upland erosion and sediment transport into the waterbody.

At stream crossings, the pipe would be buried at a depth to minimize the risk of exposure from vertical erosion or lateral migration. In the vertical dimension, the pipe would have a minimum of 3 feet of cover below the scour depth. In the lateral dimension, the vertical depth would be maintained for a minimum length of 2.2 times the active channel width, plus the channel migration zone. For streams with floodplains less than 2.2 times the active channel width, the vertical depth would be maintained across the entire width of the floodplain. Active channel migration zones and floodplains are applicable to streams with a gradient of less than 4 percent as streams with a gradient of 4 percent or greater do not have functional floodplains (Rosgen, 1996).

The specific depth that would be required at such crossings would be determined on a site-specific basis, which would require acquisition of additional detailed information on substrate characteristics, expected peak flow conditions, local bed slope, and upstream and downstream conditions. These data would be acquired before final design of the high-risk crossings.

Should channel subsidence, bank erosion, channel scour, or other negative long-term effects of Pipeline construction become apparent during post-construction monitoring, case-specific responses would be tailored to alleviate the specific problems identified.

After construction, stream banks would be restored according to plans submitted in the Applicant-Draft BA. Appendix 6A in Applicant-Draft BA (Stream Restoration Methods) shows the scenario in which various stream bank restoration techniques may be employed. Riparian habitat in the upland portions of the construction easements would be revegetated and returned to discretionary land use by the landowner, consistent with easement restrictions. Typically, FERC recommends a 10-foot-wide mow strip centered over the Pipeline (Figures 5-1 and 5-2). In addition, FERC recommends that vegetation within 15 feet of the centerline may be maintained at a height of 15 feet. The remainder of the 75- to 100-foot-wide construction easements would revert to vegetation cover preferences or requirements of the landowner. For streams that currently contain riparian cover the following revegetation scenario would be adopted, as illustrated in Figures 5-1 and 5-2:

- Riparian vegetation (trees and shrubs) would be restored continuously for a distance of that matches the width of the current riparian buffer, except for a 10-foot-wide herbaceous strip immediately above the Pipeline itself. Oregon LNG would deviate from FERC's recommendations by planting woody vegetation up to the limits of the 10-foot-wide herbaceous strip, allowing the canopy to close over the 10-foot-wide mow strip.
- Where there is preconstruction continuous riparian cover greater than 25 feet perpendicular from the top of the bank, then the riparian restoration would extend out to match the riparian width of existing conditions up to the width from the top of the bank required by the Forest Practices Act.
- Trees adjacent to the 10-foot-wide herbaceous strip may be limbed to a height of 10 feet on the interior (direction of Pipeline) side of the tree to permit passage of personnel for purposes of inspecting the Pipeline.

5.1.1.3. Mass Failures

Erosion control BMPs and the methods outlined in the FERC Plan and Procedures would be implemented to reduce the potential for mass failure. In areas where landslides are a concern but specific landslide features cannot be identified, proper construction techniques would be implemented to minimize the potential for slope failure, landslides, or erosion resulting from Pipeline installation. In general, the installation of a Pipeline below ground (and subsequent backfilling of the trench zone with native material) results in a relatively short window of disturbance and minor change in subsurface conditions. The larger changes occur at the ground surface, where topography and vegetation are altered. Therefore, the majority of the construction techniques that would be implemented are performed to restore or improve the land and drainage features after construction is complete. These techniques may include the use of water bars, terracing, diversion ditches, and other methods to control runoff and erosion. Backfill operations would be performed to ensure that the trench backfill is adequately compacted so mounding is not required. Revegetation procedures would also be implemented to ensure rapid establishment of a vegetative cover after completion of construction.

Where steeply sloped areas or mapped landslide hazard areas cannot reasonably be avoided, an effort has been made to align the pipe parallel to the maximum fall of the ground (that is, to run the pipe straight down the slope) and avoid placing the pipe parallel to the slope (that is, side-sloping the pipe). The potential for pipe damage because of soil deformations associated with rapid landslide movement is much less when the movement occurs parallel to the axis of the pipe. In areas where specific landslide hazards are identified, a number of methods are available for the mitigation of landslide deformation on pipelines. These include stabilization of the landslide, relocation of the Pipeline beyond the landslide, installation of the Pipeline above ground, installation below the landslide using directional drilling or deep excavation, or the use of deformable backfill such as polystyrene or other suitable material (Bukovansky and Major, 2002).

When avoidance measures are not practical, another option for mitigating the risks of landslide hazards includes maintaining the Pipeline within the landslide zone, which can be accomplished using a program of landslide and Pipeline monitoring. This approach is particularly well suited to existing landslide areas where movement is occurring relatively slowly, which is the case in much of the landslide topography mapped throughout the Coast Range. Installation and monitoring of equipment to monitor the movement of landslides and pipelines (and the associated strain imposed on the Pipeline) is a common method of maintaining pipelines in active landslide zones. Vibrating wire strain gauges have been used extensively during the last 20 years to monitor longitudinal pipeline strain changes caused by the landslide deformations (Bukovansky and Major, 2002). Monitoring of pipeline strains enables sensitive measurements of forces in the pipe and timely implementation of strain-relief measures if strains reach a critical level. According to Bukovansky and Major (2002), federal, state, and local agencies that regulate pipeline construction and operation in the United States generally accept strain monitoring to provide for the safety of pipelines located in areas of geologic hazards. This has contributed to the acceptance of strain gauge monitoring as a basic system for enhancing pipeline safety.

To prevent landslides at high-risk crossings, BMPs (including slope breakers, straw bales, silt fences, wattles, and subsurface drainage) would be used, as detailed in the technical memorandum titled *Landslide and Debris Flow: Relative Risk Assessment for the Bidirectional Project Pipeline* (CH2M HILL, 2013e) in Applicant-Draft BA Appendix 6B. Site-specific engineering techniques for minimizing landslide risk and for protecting the Pipeline against landslides, should they occur, are shown in drawings for each flumed and open-cut crossing that could affect ESA-listed fish (see site-specific stream crossing drawings submitted with Applicant-Draft BA Appendix 6A). The consequences of mass slope failures, landslides, persistent turbidity, and Pipeline fractures on fish and wildlife resources would depend on downstream physical and biological conditions and timing should a landslide or mass failure occur.

Because the severity of any given landslide with regard to ESA-listed fish is dependent on a nearly infinite number of variables, no generalities can be drawn. The effects could be as minor as a short-term pulse of turbidity that would require no corrective action or as severe as complete blockage of upstream migration. Should a landslide occur that is due to Pipeline construction and not other natural processes, ODFW, NMFS, and other interested parties would be consulted to design a site- and case-specific plan to mitigate any negative effects.

5.1.1.4. Increased Turbidity and Sediment Loads

Increased turbidity from construction at many crossings was avoided through the use of HDD methods. Turbidity would be further minimized through the use of dry crossing (flume) techniques. Before construction begins, the action areas would be surveyed to ensure that no spawning is occurring at the crossing location or within 500 feet downstream. If spawning is occurring, construction would be postponed until fry have had adequate time to leave the redds. The FERC Procedures would be followed to limit water quality effects on waterbodies during construction. BMPs and erosion and sediment control measures also would be implemented, as described in the SWPPP submitted to FERC in June 2013 (see Appendix B). In addition, a National Pollutant Discharge Elimination System (NPDES) 1200-C construction stormwater discharge permit would be obtained before construction of the Project.

During construction of the Pipeline across perennial streams, measures to avoid construction-related effects would include placing spoils at least 150 feet from the water’s edge or in ATWS; using erosion and sediment controls to prevent the excessive delivery of sediment to waterbodies; and, where temporary vehicle crossing is needed, following the FERC Procedures for temporary equipment bridges. ATWS would be located at least 150 feet from the top of bank.

Crossing methods for each stream were determined based on field surveys, agency consultation, and review of fisheries data. The following general conservation measures would be employed at flume crossings:

- Dams would be constructed of sandbags and plastic sheeting or other materials that would not contribute sediment to the stream channel.
- Sandbags would be filled with a nonleachable material such as clean, prewashed sand.

- Sandbags would be tied securely before they are installed, and sheets of plastic would be interwoven between the layers of sandbags to ensure an effective seal.
- At the flume outfall, flow would be dissipated as needed to avoid disturbing streambed sediments.
- Work would be conducted during the summer to early fall (periods of low flow), thus minimizing risks of bank failure.

To prevent sedimentation caused by construction and vehicular traffic crossing perennial waterbodies during clearing operations, two stream crossing techniques would be employed. Equipment either would be transported around streams or would cross on temporary bridges, as described in Section V of RR2 Appendix 2B. There would be little concern for erosion associated with flooding at the bridge crossings. However, some temporary bridges may need to be reset to facilitate stream crossings in the fall or winter in support of final stream bank restoration. In many cases, it would be possible to access the opposite side of larger streams from alternative access routes that would not require bridging the stream. At some of the flumed crossings where the stream/slough bottom is too soft to support the trenching equipment, temporary fill material (coarse rock) would be placed within the area isolated by the dams to allow a solid crossing foundation. This fill material would be removed before the dams are breached and would be transported to an upland location at least 150 feet from the stream channel.

After completion of construction, a report would be prepared for submittal to NMFS that would include the following:

- Fish monitoring and turbidity data taken during construction
- Dates and times of activities
- Description of the construction activities and associated downstream turbidity
- Any corrective actions taken to reduce turbidity
- Any reporting requirements of the 401 State Water Quality Certification issued for this Project
- Amount or extent of incidental take that has occurred, including a description of any dead or distressed salmonids, and the total amount of disturbed habitat
- An assessment of stream habitat conditions within the easement and downstream following construction

5.1.1.5. Water Temperature

Streams that are listed in the 1972 Clean Water Act § 303(d) as temperature sensitive along the Pipeline would be crossed using HDD, thereby avoiding loss of streamside shade in these temperature-sensitive streams. At flume and open-cut crossings, the removal of riparian vegetation would be minimized to the extent possible. However, based on the technical memorandum in Applicant-Draft BA Appendix 10, *Characterizing Deforestation Impacts on Stream Temperature* (CH2M HILL, 2009), even in the event that the full 100-foot construction corridor is cleared, it is unlikely that the resultant increase in incident solar radiation would be sufficient to cause biologically significant increases in downstream water temperatures. Revegetation of the easement over the long term (described above) would eliminate any small increases in water temperature that do result.

5.1.1.6. Large Woody Debris

In areas where unmerchantable trees or downed LWD greater than 12 inches in diameter at breast height occur within the Pipeline construction areas (i.e., permanent easements, temporary workspace [TWS], and ATWS), some of the material would be salvaged for retention on wood-deficient soil surfaces, consistent with wildfire protection regulations, or in stream channels in accordance with ODF and ODFW wood placement guidelines. Some of the unmerchantable LWD resulting from clearing would be stockpiled for redistribution to the site as part of post-construction rehabilitation, particularly the portion of the construction corridor outside the 50-foot operational/maintenance easement. To compensate for the disruption of LWD recruitment potential and shifting of instream LWD, LWD removed during construction would be replaced and the riparian corridor replanted, as described previously, to replenish source areas for LWD recruitment over the long term. A monitoring plan for evaluating the effectiveness of LWD replacement would be prepared as part of the overall Pipeline monitoring plan. This plan would be developed before construction and would require agency approval before implementation. In this way, existing conditions with respect to LWD are expected to be maintained.

5.1.1.7. Frac-outs

Frac-outs are not anticipated, but their effects (should they occur) would be minimized through the use of the following conservation measures. The Spill Prevention, Control, and Countermeasures (SPCC) Plan for the Project (see Appendix B) outlines procedures for dealing with a frac-out. Depending on the severity of the release, the most common first step for the HDD contractor in reestablishing circulation and sealing fractures is to use a thicker, lower-viscosity mixture of sodium bentonite and water. The thicker mix of sodium bentonite and water would be more effective in forming a filter cake on the inside wall of the borehole and soil/rock particles around the borehole to seal voids and prevent further release of drilling mud. In some cases, unhydrated sodium bentonite chips would be pumped through the drill rods. These granules of bentonite would flow in and fill or bridge a void or fracture. They would hydrate and swell in the presence of the drilling fluid to seal off leaks or fractures.

If the problem is more severe, standard drill fluid additives would be used. These drill fluid additives commonly consist of polyanionic cellulose (PAC), or water–swellable synthetic polymers capable of absorbing many times their weight in water. These materials work in a similar manner to the granular bentonite; that is, they are pumped through the drilling system and allowed to swell to seal voids and fractures.

These leak-stopping additives may then be released into aquatic systems, potentially exposing fish and other aquatic biota. The toxicity of leak-stopping additives and their ingredients is summarized in Table 3.5-6 of the Applicant-Draft BA. Because it is not known which products would be used, ecological toxicity data were reviewed for 11 leak-stopping products from four of the largest manufacturers of drill-fluid additives. Key ingredients and Chemical Abstract Service (CAS) numbers (if presented) were obtained for each product. Ecological toxicity data were also obtained from the manufacturers. If ecological toxicity data were not available, the manufacturers were contacted to determine whether data could be obtained. In addition, searches were conducted of the USEPA Ecotox database and of published literature to identify whether ecological toxicity data were available. Searches were based on the CAS numbers of key ingredients in the products and focused exclusively on aquatic toxicity data (i.e., effects on fish and invertebrates).

Ecological toxicity data were identified for at least one of the key ingredients for 9 of the 11 products considered (Applicant-Draft BA Table 3.5-6). Ecological effects data were not reported in the Material Safety Data Sheet (MSDS) for Fed Seal (manufactured by Federal) or Cel-U-Seal (manufactured by Alpine), and data for their key ingredients could not be identified in published literature. Because the ingredients of these products consist of cellulose, paper, and other natural fibers, toxicity is likely to be low.

Ecological toxicity data were available for key ingredients for the nine remaining products, except for crystalline silica quartz and crystalline silica tridymite. Because these ingredients represent 1 percent or less of each product, as silica compounds are expected to be comparable to sand, they are considered unlikely to contribute to toxicity.

Three of the products are composed almost entirely of PAC or carboxymethylcellulose sodium salt (Applicant-Draft BA Table 3.5-6). PAC polymer is virtually nontoxic to fish; 96-hour LC50s (concentrations resulting in 50 percent mortality) ranged from 17,000 milligrams per liter (mg/L) to greater than 20,000 mg/L. Invertebrates, however, are more sensitive; the 48-hour EC50s (concentration producing an effect [immobilization] in 50 percent of exposed individuals) for daphnids ranged from 87 to 123 mg/L.

Two products (Polyswell and Macro-Fill) were composed of acrylamide polymer. Acrylamide polymer may be either anionic or cationic. Whereas anionic acrylamide polymer has a 96-hour LD50 for fish greater than 600 mg/L, cationic acrylamide polymer is much more toxic with a 96-hour LD50 for fish of 2 mg/L. Polyswell is identified as an anionic acrylamide polymer; the MSDS for Macro-Fill is not explicit about its composition.

The remaining four products are composed of inorganic materials (clays, salts, and silicates). The key ingredients are bentonite clay, smectite clay, or gypsum (calcium sulfate). The clays have the lowest toxicity (fish LC50 =

19,000 mg/L), followed by gypsum (fish and daphnid LC50s greater than 1,970 mg/L). Toxicity testing conducted by the manufacturer for one of these products (Max Gel) indicates that the fish LC50 for the formulated product is greater than 10,000 mg/L (Table 3.5-6).

In conclusion, leak-stopping products formulated from clays, gypsum, and silica have the lowest toxicity to fish and invertebrates. Products consisting of PAC or carboxymethylcellulose sodium salt have equally low toxicity to fish, but are moderately toxic to invertebrates. Products consisting of acrylamide copolymers may be more toxic to fish. However, the available toxicity data are limited (the maximum concentration tested was 600 mg/L; it is uncertain whether higher concentrations are toxic). Effects of acrylamide copolymers on invertebrates are uncertain. Although toxicity data for products formulated from cellulose, paper, and other natural fibers were lacking, toxicity is likely to be low. Even in the event of invertebrate toxicity, the additives likely would be bound to the bentonite and be poorly soluble in water. Because of the volume of river flow, the proposed cleanup provisions for frac-outs, and the demonstrated low toxicity, the effects of these additives is expected to be extremely limited.

In the most severe cases, standard drill fluid additives may not be sufficient to seal fractures and reestablish circulation of drill fluid. In these conditions, coarser bridging agents may be required. These bridging agents may take the form of fiber, flake, or granular materials (Canon, 2003). Examples of fiber additives are cellulose fiber, cedar (or other wood) fiber, cane fiber, or spun mineral fiber. Mica is one of the most common examples of flake additives. Granular additives include nut hulls and granular bentonite (discussed above). Most of these bridging agents come in different sizes, from coarse to fine, and many manufacturers of drill fluid additives provide specially designed materials that may contain a combination of various bridging agents and polymers.

Should the above methods prove unsuccessful, and HDD drilling fluid is released to water, appropriate local, state, and federal agencies would be notified, and a determination whether to cease operations would be made in accordance with the SPCC Plan for the Project (see Appendix B). The extent of the release would be assessed, and appropriate corrective actions would be taken. These corrective actions may range from simple monitoring in the case of small releases, to active cleanup using specialized pumps and filters, to abandonment of the HDD and sealing of the hole. In the event of an HDD drilling fluid release to land, the release and drilling hole entry point would be contained with berms, pumps, hay bales, sediment fencing, wood products, or other appropriate means, and the fluid would be cleaned up immediately using hand tools or vacuum trucks and transported to an approved disposal location.

5.1.1.8. Fish Passage

Three potential project actions are triggers for fish passage review and authorization for the Oregon LNG project: temporary coffer dams and dewatering work areas at stream crossings where trenching is the construction method; exposure of the pipeline as a result of stream erosion, post-construction; and new or replacement culverts where road improvements are required. Impediments to fish passage were avoided as much as possible through conscientious Pipeline siting and the judicious use of HDD methods. Trench construction would take place during summer in-water work windows when intermittent and ephemeral streams are expected to be dry and flows in perennial streams are at seasonal lows. In the spring and summer of 2015, Oregon LNG will be conducting supplemental field studies to evaluate the potential for scour at stream crossings. The results of 2015 field studies will supplement completed preliminary risk analysis and further inform which streams are at risk for vertical sour or lateral movement. The degree of risk would inform the depth of pipe burial and other in-stream restoration measures that could be applied to ensure that practicable measures have been taken to reduce or eliminate the risk of pipe exposure, post-construction. Access roads were examined and culvert replacements are not anticipated. Therefore, fish passage as a result of replacing culverts beneath roads is not a fish passage trigger.

The following conservation methods would minimize negative effects on fish passage. Most stream crossings would be completed within 24 to 48 hours of initiation, thereby limiting possible effects on fish passage. With the few exceptions noted previously, streams known to support anadromous fish would not be crossed during periods of adult upstream migration. Downstream juvenile salmonid migrations would continue during construction through the bypass flume. Oregon LNG committed to burying the pipeline below the scour depth. The depth of pipe burial would depend on the risk of vertical scour or lateral movement of a stream. The following courses of action would be taken:

1. Submit fish passage applications to ODFW prior to FERC's issuance of the final Environmental Impact Statement
2. Construct and install upstream passage in conformance with the ODFW passage regulations (ODFW OAR 635-412-0005).
3. Restore streambeds and stream flows to baseline conditions in the same in-water window as pipeline construction
4. For streams at a low risk of scour, bury pipeline at a standard depth (minimum three feet of cover between the pipeline and streambed)
5. For streams at moderate to high risk of scour, bury pipeline below the scour depth or at a depth that minimizes the likelihood of exposure when other in-stream enhancements are applied
6. At moderate to high risk streams, apply in-stream enhancements (rock and/or large wood) that would help direct and control flows to protect the streambed and reduce the likelihood of scouring; in-stream enhancements could be used to reduce the depth of pipe burial
7. Use bioengeered approaches to restoring streambanks (see Table 6A-1 in Applicant-Draft BA Appendix 6A
8. Engineer flume sizes to accommodate storm surges that could occur during construction

During construction, regardless of duration, adequate flow rates would be maintained to protect aquatic life and avoid disruption of downstream uses. The area within 1,000 feet downstream of each crossing would be monitored for distressed fish and other aquatic biota. NMFS would be notified within 3 working days after a dead, injured, or sick individual of an endangered or threatened species is located. Initial notification would be made to the NMFS Law Enforcement Office. Notification would include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Upstream passage of migratory fish is not likely to be impeded given that Pipeline construction would take place within in-water work windows approved by ODFW and NMFS, flows will be restored in the same in-water work window as construction, and many streams would be crossed using the HDD method.

5.1.1.9. Water Withdrawals and Discharges

During Pipeline construction, water withdrawals and discharges cannot be avoided. However, the following conservation measures would minimize the negative effects.

Water withdrawals and discharges would be required for HDD drilling and hydrostatic testing. In addition, leakage from the dams, or subsurface flow from below the waterbody bed, may cause water to accumulate in the isolated crossing area. As water accumulates, it may be pumped out periodically and discharged into energy dissipation/sediment filtration devices, such as a geotextile filter bag or straw bale structure, or into well-vegetated areas away from the water's edge (see Applicant-Draft BA Figure 2.5-3).

The amount of water required for HDD drilling operations would be small relative to the available sources, and no negative effects are anticipated. Conservation measures would include appropriate screening of water intakes to ensure no entrainment or impingement of juvenile salmonids.

Hydrostatic testing would be conducted in accordance with the requirements of United States Department of Transportation Pipeline safety regulations, 49 Code of Federal Regulations (CFR) 192, Oregon LNG testing specifications, and applicable permits. Oregon LNG is proposing to use municipal water for a significant portion of hydrostatic test water. Use of municipal water would minimize concerns about potential cross-contamination between watersheds and quality of water that would be discharged back to streams. Discharge sites would be near sources to provide for recharge, but they would be in uplands sufficiently removed from the sources to prevent immediate direct surface water return. Environmental effects from the withdrawal and discharge of test water would be minimized by applying the measures indicated in the FERC Procedures and through prudent implementation of the following measures:

- Withdrawals and discharges to water sources would be done in compliance with appropriate agency requirements that consider the protection of fishery resources on a case-by-case basis.
- Compliance would occur with appropriate permits and instream water rights.
- Intakes would be screened to avoid entrainment of fish and aquatic species in accordance with NMFS fish screening criteria. A diagram of a typical fish screen at a water intake is provided in Applicant-Draft BA Figure 2.5-2 as an example.
- Adequate flow rates would be maintained during withdrawals to protect aquatic life and provide for waterbody uses and downstream withdrawals of water by existing users.
- The discharge pipe would be anchored for safety.
- The overall rate of discharge would be controlled to prevent flooding and erosion.
- Test water would be discharged to straw bale dewatering structures to dissipate energy, reduce velocities, and spread water flow to avoid erosion and promote ground penetration. The base of the structure would consist of a 24-foot-square, single layer of tightly packed straw or hay bales. A second layer of bales would be placed atop the perimeter of the base layer as a rim to contain the discharge water, and the whole would be surrounded by silt fence. A final layer of bales would then be placed around the outside of the silt fence and staked into place. The dewatering structures would be closely monitored for structural integrity and to ensure that the water does not overtop the rim. The dewatering structures would effectively dissipate energy, reduce velocities, and spread water flow to avoid erosion and promote ground penetration.
- Test water would be discharged only in uplands across well-vegetated areas.

Because of the short residence time of the test water in the Pipeline system, the use of biocides or other hydrostatic test water additives would not be required. Water testing before discharge would not be required because no contaminants (oil, grease, solvents, etc.) are used in the construction procedures for the Pipeline. Dirt and scale from inside the pipe would be filtered out by the straw bale enclosure or other filtering device.

At the time of testing, the Pipeline would be buried and insulated from solar heating. The water would be conveyed to the Pipeline from the source areas through temporary piping. Where fish are present, water would be withdrawn through screened intake structures that comply with ODFW and NMFS requirements. The actual size and type of screen to be used would be determined through consultation with ODFW during the Limited Water Use License application process based on information provided by the Oregon Water Resources Department on water availability. This information would be used to determine the most appropriate withdrawal rate and screen size. Depending on the outcome of the Limited Water Use License application process, intake pipefish screens could range from 2.8 square feet to more than 33 square feet in size.

Hydrostatic test water would be discharged near the point of diversion to prevent cross-watershed disposal whenever possible. Discharge of the water would be performed to prevent spread of organisms and to prevent erosion and reduce turbidity by using erosion control structures and energy-dissipating devices (see Applicant-Draft BA Figure 2.5-2). Turbidity levels would be maintained in accordance with those outlined in the NPDES permit issued by ODEQ or the 1200-C construction permit issued by Clean Water Services.

Transfer of water between basins (Northern Oregon Coastal, Lower Columbia, and Willamette) would be avoided, except where municipal water is the source. Whenever possible, the water would be discharged within the subwatershed from which it was obtained, but it may be transferred from one section of pipe to the other, and ultimately discharged in a different subwatershed. In the event of discharge to a subwatershed different from that where the water was withdrawn, it would be discharged only to a straw-bale dewatering structure in upland areas sufficiently far from waterbodies to ensure complete infiltration. Water withdrawals would be conducted in accordance with existing water rights, such that no withdrawal would over-appropriate any given stream. In addition, withdrawals would be conducted in consultation with ODFW district fish biologists to ensure that the withdrawals avoid particularly sensitive stream reaches. The discharge rate would also be carefully metered to ensure infiltration and avoid overland flow. Infiltration of the water in upland areas should effectively preclude the cross-watershed transfer of any exotic aquatic species or pathogens that may be present in the water.

Careful adherence to appropriate regulations and implementation of BMPs would ensure that existing conditions are maintained.

5.1.1.10. Hazardous Materials Release

During consultation with ODFW, USFWS, and NMFS, it was agreed that unless approved by all three agencies, ATWS would be set back 150 feet from streams and wetlands. In addition, overnight parking of vehicles, storage of fuels and other hazardous materials, and refueling activities would take place no closer than 150 feet from a stream or a wetland, unless full containment of potential contaminants is provided. Under certain clearly defined conditions, and subject to agency approval, ATWS may be placed closer to waterbodies or wetlands where the ATWS placement would not increase effects on streams or fish habitat. This BMP, combined with observance of the conditions of the Sediment and Erosion Control Plan, would ensure that hazardous materials would not be released from construction equipment into any Pipeline action areas.

5.1.1.11. Cross Contamination Among Waterbodies

Cross contamination from water discharges is discussed above. Cross contamination from dirty construction equipment would be avoided through compliance with an equipment decontamination plan. The plan would encompass large equipment (such as excavators, earthmovers, and trucks), as well as small hand tools. Oregon LNG proposes the following risk minimization and equipment decontamination standards:

- Vehicular traffic would be kept to the absolute minimum necessary.
- Before equipment remobilizes to a new crossing location, cross contamination and loose debris (e.g., caked mud and dust) would be removed using scrapers or brushes. Solids would be removed from equipment and tools to the extent feasible and spread onsite.
- Hand tools would be immersed in a warm soap-and-water solution and/or a solvent rinse using alcohol (methanol or isopropanol).
- Decontaminate equipment by steam cleaning, pressure washing, or washing in soapy water (e.g., Alconox or other phosphate-free detergent), followed by a clean water rinse.
- Decontamination would take place in designated decontamination areas with the following features, or with alternative features that provide an equivalent level of protection:
  - Puncture-resistant geomembrane/plastic sheeting robust enough to resist damage from vehicle traffic
  - Adequate size to accommodate the largest anticipated equipment, plus workspace for decontamination technician(s)
  - Adequate water from a stationary tank, water truck, or municipal/private supply
  - Bermed sides or sloped topography permitting the complete collection of spent wash water
  - Sides or curtains to contain splash or overspray
  - A tank or tank truck for storing spent wash water
- Spent wash water would be hauled offsite and disposed of in a publicly owned treatment works (POTW) unless proper discharge permits are obtained for onsite disposal.

It is anticipated that implementation of the final decontamination plan would be adequate to prevent the spread of pathogens and non-native species, and thereby maintain existing conditions. The final decontamination plan would be completed and approved by ODFW and NMFS before any work begins.

5.1.2 Terminal

The potential Terminal site effects on individual ESA-listed fish, critical habitat, existing conditions, and on individual ESUs not related to critical habitat are summarized in Table 3.5-12 of the Applicant-Draft BA.

Overall, the Project would have limited negative effects that would be offset by the proposed conservation measures. Following successful implementation of conservation measures, the overall result of the Project is expected to be neutral to positive.

5.1.2.1. Dredging

In-water work associated with dredging would be conducted during a proposed spring to fall extension of the work period. This would allow disposal to occur at USEPA permitted disposal sites at the Deep Water disposal site. It would also minimize the effect on eulachon, while mirroring channel maintenance dredging activities, which have been found to not jeopardize the existence of ESA-listed salmonids.

Other minimization techniques include use of pipeline, clamshell or hopper dredges, and turbidity monitoring. Compensatory mitigation at the Youngs River Mitigation Site (discussed below) is proposed to compensate for the small negative effects on the food web and physical habitat of juvenile salmonids, green sturgeon, and eulachon.

Direct Lethal Take

The following conservation measures would be implemented:

- Hopper dredging
  - Maintain dragheads in the substrate no more than 3 feet above the river bottom when the dredge pumps are running.
- Clamshell dredging
  - Clamshell dredging is not expected to cause direct mortality to adult or juvenile listed or proposed fish species, because the movement of the bucket is typically slow enough for fish to avoid entrainment.
- Pipeline dredging
  - Maintain cutterhead in the substrate during dredging, and if cutterhead cleaning is needed, do not raise the cutterhead more than 3 feet above the river bottom when the dredge pumps are running.
- General provisions for dredging
  - The contractor shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway.
  - The contractor, where possible, would use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.
  - Dredging would occur in relatively deep water areas and, therefore, should “avoid” areas where subyearling Chinook and chum salmon are present. Dredging may also be performed with a clamshell bucket dredge, which is unlikely to entrain salmonids or other ESA-listed or proposed species.
  - If at any time during dredging activities, listed salmonids are observed in distress or a listed salmonid is killed, operations would cease and NMFS would be notified.

Turbidity

Hopper and pipeline dredges generally do not produce large amounts of turbidity during dredging because of the suction action of the dredge pump and the fact that the drag-arm or cutterhead is buried in the sediment. Therefore, should they be employed, fewer conservation measures would be required. The following measures would be employed:

- Hopper and pipeline dredging
  - The cutterhead shall remain below the surface of the river bottom at all times while the hydraulic pumps for the cutterhead are running. The hydraulic pumps for the cutterhead shall be placed in neutral (idling) before raising the cutterhead above the river bottom. Backwashing of the hydraulic-pipeline dredge intake line shall only occur in water depths greater than -40 feet mean lower low water.
- Clamshell Dredging
  - BMPs used to control turbidity include regulating the bucket speed, ensuring the bucket lips are closed before lifting the bucket out of the water, filling the bucket to capacity to minimize water in the bucket, not overfilling the bucket, and modifying the bucket size and/or type, if necessary.
- General provisions for dredging
  - Dredging and global positioning system software would be used to model the dredge prism and track previously dredged areas to ensure that dredging efficiency is maximized. As an incentive to the dredging contractor to dredge only the authorized amount, the contractor would be held accountable should they dredge in excess of the authorized depths. Post-dredge bathymetry surveys would be conducted to ensure that only the material identified for removal before dredging was removed to the authorized depth.
  - If a bottom dump barge is used to transport the sediment to a disposal site, no material shall be allowed to leak from the barge or overtop the walls. The barge would be loaded so that enough of the freeboard remains to allow for safe movement of the barge and its material on route to the unloading facility.
  - Regardless of the assumptions and predicted levels of increased turbidity because of dredging, dredging operations would be monitored while they are being conducted and would be required to meet stringent ODEQ regulations designed to be protective of fish and their food resources. Dredging currently occurs in similar and nearby environments (that is, maintenance dredging of the shipping channels and Astoria harbor) in compliance with these ODEQ standards. Daily monitoring and reporting of turbidity are required by ODEQ for dredging operations in the LCRE, and these requirements should prevent any detrimental effects on listed or proposed fish species or their food resources from excessive turbidity. As demonstrated by previous dredge operations, ODEQ's regulatory standards can be met using modern dredging equipment and containment measures. Any elevation in turbidity would be localized and short-term, quickly returning to background levels. Existing conditions would be maintained.

Resuspension of Toxics

Results of the dredge characterization studies indicated that no contaminants were present that exceeded screening levels in the Sediment Quality Guidelines for standard chemicals of concern from the Regional Sediment Evaluation Team (USEPA and USACE, 2006). On the basis of these results, it can be expected that existing conditions would be maintained as the release of toxic substances from dredged materials is expected to be minimal and no adverse effects are anticipated. Therefore, no conservation measures are necessary.

Food Web Effects

Negative food web effects were minimized through siting of the Terminal in relatively unproductive deep water. Dredging would directly remove some salmonid and green-sturgeon food organisms and cause a long-term shift in the species make-up of benthic organisms at the Terminal location. Likewise, periodic maintenance dredging at approximately 3-year intervals would temporarily remove benthic organisms from the berth and turning basin for the life of the Project. However, because benthic sampling indicated that salmonid food organisms are relatively scarce in the dredge prism, and similar food resources are plentiful throughout the estuary, no onsite mitigation is proposed.

5.1.2.2. Dredge Disposal

Negative effects of dredge disposal would be minimized by disposing of dredged material in previously approved dredged material disposal sites. Disposal at these sites has previously undergone consultation by NMFS, who found that operation of the disposal sites was unlikely to affect ESA-listed fish in the LCR on the population level.

5.1.2.3. Construction of the Pier and Access Trestle

Lighting

As stated above, construction would be conducted during daylight hours, so construction lighting would be minimal. However, some lighting would be required early and late in the workday and for security during nighttime hours. Measures to minimize the potential for lighting effects on fish resources include use of the following:

- Directional lighting facing away from the water to the extent possible
- Screens or lighting hoods
- Minimum light possible to safely perform the task
- Full-cutoff light fixtures, which have no direct up-light, help eliminate glare, and are more efficient by directing lighting down to the intended area

Acoustic Effects

Avoidance and Minimization measures that are proposed include the following:

- Observance of the in-water work period unless otherwise approved by ODFW and NMFS
- Possible curtailment of pile driving in February
- Vibratory hammers
- Pile caps/hammer cushions
- Bubble curtains
- Noise monitoring during construction

The in-water work period for the LCRE (November 1 to February 28) would be observed for pile driving, unless extended under authorization of ODFW and NMFS. Pile driving may be conducted 7 days per week during daylight hours, which average (sunrise to sunset) approximately 9.5 hours from November to February. Pile-driving activities require extensive setup, tear-down, and monitoring, which results in a maximum 4 hours per day of actual pile driving. Therefore, the duration of sound production would be significantly less than the total in-water work period, further minimizing effects on fish. NMFS has previously found that conducting pile driving during in-water work periods in the LCRE minimizes negative effects because juvenile salmon and steelhead abundance is low and any fish present would likely relocate away from the affected area (NMFS, 2003b).

Because 85 percent of the fish present during the work window occur during February, reasonable attempts would be made to complete pile driving during the period from November 1 to January 31. As construction progresses, the likelihood of completing pile driving during that period would be assessed in early January. If the contractor feels that pile driving cannot be completed within one in-water work window, pile driving would cease on January 31 and resume during the in-water work period of the following year. If the contractor feels that pile driving can be completed by extending into the first week or two of February, pile driving would proceed to completion, in order to avoid remobilization to the site. By eliminating or substantially reducing the amount of pile driving in February this conservation measure would further reduce effects on LCR subyearling Chinook by 50 to 85 percent.

Driving piles with impact hammers is more sound-intensive than with vibratory hammers and would be avoided whenever site conditions allow. It has been shown that fish can be startled by the first few strikes of an impact hammer, but they may then become acclimated and remain in the area, increasing their exposure to potentially harmful sound levels (NMFS, 2003b). Vibratory hammers produce lower intensity sound waves compared with impact hammers, and fish exhibit avoidance responses to vibratory hammers without becoming acclimated

(Dolat, 1997; Knudsen et al., 1997). Therefore, vibratory hammers would be employed whenever possible. However, because of the depth to which the piles must be driven and the substrate conditions, it is anticipated that an impact hammer would be required for a substantial portion of the pile driving. To reduce the sound produced by pile driving, technologies to reduce sound pressure levels by approximately 20 decibels (dB) would be employed. These technologies would likely include some combination of bubble curtains, bubble curtains confined in an isolation casing, bubble curtain tree, hammer cushions, and possibly dewatered cofferdams or sandbag rings in shallow intertidal areas. Comprehensive descriptions of most of these technologies and their effectiveness in reducing sound levels are available in Illingworth and Rodkin's *Compendium of Pile-Driving Sound Data* (2007), and IFC Jones and Stokes et al. (2009).

The sound produced by driving any particular pile is influenced by multiple site-specific variables, including currents, tidal condition, water density differences caused by differing salinities, substrate types, angle of the pile, water temperature, bottom topography, and barriers such as shoals. Because no models exist that accurately incorporate the multiple variables that can affect sound propagation, the actual risk posed by pile-driving noise would be monitored during operations through the use of hydrophones. This is described in detail in Applicant-Draft BA Appendix 8, *Oregon LNG Terminal and Oregon Pipeline Project—Underwater Noise, Propagation, Monitoring, and Mitigation* (CH2M HILL, 2011). Potential negative effects would be minimized by adapting noise attenuation techniques based on measured sound pressure levels. Because achieving maximum noise attenuation relies on many interconnected and compounding factors, only a contractor with significant experience with pile driving in similar tidal systems would be selected. Because of increasing concern with noise effects on aquatic biota, contractors are available who are familiar with minimizing the negative effects of in-water construction. Adaptive management strategies could include modification of bubble curtain design, change in hammer size and type, change in pile cap material, or other techniques as agreed upon during consultation with NMFS, should further noise attenuation methods be necessary.

A written report on hydroacoustic monitoring would be provided to NMFS following completion of the work. Conservation measures (creation of new shallow water habitat at the dredged material disposal site and new estuarine marsh habitat in Youngs Bay) are also proposed that should more than offset the one-time effects associated with pile driving.

Hazardous Materials Release

Over-water construction vessels would be fueled at existing commercial marine fuel docks. Such facilities have existing spill prevention systems in place that would be adequate to avoid spills or immediately address any accidental spills that do occur. The only potential sources of contaminants (lubricating oils and fuel) at the pier, mooring dolphin, and access trestle would be the construction equipment itself.

General BMPs are proposed in Oregon LNG's SPCC Plan (Appendix B). The SPCC meets state and federal agency requirements before commencing work. Proper execution of this plan and consistent implementation of BMPs would ensure that existing conditions are maintained. Oregon LNG would include a final SPCC Plan as part of the construction plan set package.

BMPs to be employed during concrete pouring on over-water portions of the pier and access trestle are as follows:

- Watertight forms
- Watertight "walkway" around each pour that is at least 3 feet wide so that misplaced concrete is intercepted before entering the water
- Preconstruction spill response plan (which is the responsibility of the contractor)

5.1.2.4. Construction of the Onshore Facilities

Habitat Loss

The footprint of the shore-based facilities has been modified several times during conceptual design to avoid and minimize effects on important estuarine habitat. Early versions of the site plan extended into the intertidal mudflat habitat and had a substantially larger footprint. The proposed footprint maintains existing intertidal mudflat habitat and minimizes degradation (through loss of habitat) of high and low marsh habitats.

Hydrostatic Testing

Conservation measures employed to minimize negative effects during hydrostatic testing of the LNG storage units are as follows:

- Screening the intake in accordance with NMFS intake screen criteria for avoidance of entrainment of juvenile salmonids. The technical memorandum titled *Oregon LNG—Deluge Fire Suppression System Intake Structure* (see Applicant-Draft BA Appendix 3) illustrates the proposed screen for water withdrawals from the Columbia River.
- Maintenance of the intake depth in the middle of the water column to minimize turbidity and prevent disturbance of the waterbody substrate
- Maintenance of adequate stream flow rates to protect aquatic life, provide for waterbody uses, and downstream withdrawals of water by existing users
- Discharging test water to the Warrenton POTW

Hydrostatic test water withdrawal is a nonconsumptive use of water because the water would be discharged to the Columbia River through the Warrenton POTW. The discharge rate would be metered to accommodate the system capacity, as specified in applicable permits, and to mitigate any negative effects on the receiving body; therefore, the action is expected to maintain existing conditions. Because no significant negative effects are anticipated, no mitigation is proposed.

Surface Runoff and Hazardous Materials Release

An Erosion and Sediment Control Plan has been developed for implementation during site construction. The plan was developed in accordance with ODEQ's *Erosion and Sediment Control Manual* (ODEQ, 2005b). This would ensure that (1) proper controls are in place to prevent surface water contaminants and sediments from reaching the estuary, and (2) current conditions are maintained.

Concrete would be employed during construction of the onshore LNG storage tanks for soil improvement, but runoff would be contained with silt fences, straw bales, and other stormwater control devices. Concrete would not be poured during storms or extreme high tides. Concrete equipment wash-out would be conducted on upland areas away from drainage features and no concrete or runoff would be allowed to enter the LCRE.

5.2 Compensatory Mitigation

This section describes the unavoidable Project effects on federally listed and proposed fish species and critical and Essential Fish Habitat (EFH), and addresses the mitigation measures proposed to compensate for these effects, along with the rationale for the level of mitigation required for each ESU/Distinct Population Segment (DPS) known to occur within the Project action areas. Mitigation for nonlisted fish species is also addressed in this section but in somewhat less detail. Avoidance and minimization measures are discussed in Section 5.1. Stream bank restoration and the replacement of LWD at Pipeline crossings are considered conservation measures and not compensatory mitigation.

The goal of the mitigation program is no net loss, of either individual ESUs/DPSs or habitat function. In order to compensate for individual fish lost to Project activities, mitigation is needed that results in increased survival of juveniles spawned in existing areas or the reestablishment of access to currently blocked spawning streams or rearing habitats. Such mitigation efforts could include riparian plantings, culvert replacement, diversion dam removal, return of water rights to instream use, habitat enhancement (e.g., LWD placement), restoration of tidal hydrology to diked estuarine wetlands, or monetary contributions to future restoration efforts.

5.2.1 Unavoidable Effects

The primary sources of direct take of listed fish species include noise effects from pile driving and fish salvage at Pipeline crossings. Direct take from ballast/cooling water is expected to be insignificant. Take associated with salvage at Pipeline crossings would primarily involve "harassment" with a much smaller amount of direct mortality (Table 5-2). The methods for estimating take from these activities and the extent of the anticipated take are detailed in the Applicant-Draft BA. The initial modeling of take from ballast and cooling water withdrawal assumed 125 import ships per year, all of which would require ballast water. With the bi-directional Terminal, only an estimated two ships per year would be import ships requiring ballast water. Therefore, although Table 5-2 lists salmonid take from ballast and cooling water withdrawals, the actual take from those operations is likely to be much less, with zero take of listed salmonids more likely than the take reported in Table 5-2.

Other sources of direct take (including harassment), identified for the Project include dredging and ballast entrainment, turbidity (from dredging, dredge disposal and Pipeline construction), passage impediments (during Pipeline construction), and artificial light, and shading. Identified sources of indirect take include food web effects (due to dredging, dredge disposal, and sediment deposition during Pipeline construction), habitat alteration, and loss of riparian vegetation (leading to sediment inputs, increased water temperature, loss of LWD recruitment, and increased risk of mass failure).

It was estimated that 0.3 percent of the area/time is available for salmonid migration. If the dredging was done over 1 year and conducted during the late part of the dredge season (July to October), or over two years in September and October, it would effectively avoid the smolt migration period entirely, eliminating the potential for entrainment. Dredging during the spring to fall time period would also completely avoid adult eulachon and would coincide only with the very latest downstream drifting juveniles during the first month of dredging. As discussed in the Applicant-Draft BA, neither the hydraulic dredge nor the clamshell dredge is likely to result in take of juveniles or adults of listed salmonid species. No species-specific estimates of take were made for any effects aside from ballast/cooling water withdrawal, fish salvage and pile-driving noise because there are no reliable methods for quantifying such take. Therefore, the amount of take from these other sources was assumed to be low but not entirely discountable.

The degree to which species are susceptible to such effects as habitat loss/alteration, removal of riparian vegetation, etc. is dependent on their use of the affected habitats. Several species, including steelhead trout, sockeye salmon, and yearling (spring/summer) Chinook salmon move very quickly through the estuary and therefore, would be largely unaffected by the minor changes in food resources associated with deepening the river at the berth and turning basin. The relative degree to which species could be affected by various unquantified sources of take is illustrated in Table 5-3. In Table 5-3, species are rated on each effect from 1 to 3, with "1" being low effect and "3" being high. If a species would be unaffected by a given parameter or the effect is so small as to be biologically insignificant, it is given an "N/A" (not applicable) ranking. The rankings are based on the effects on a given species relative to the effects on other species; not the effects resulting from that parameter relative to other parameters. For instance, a species may rank "3" on artificial light and shading because it is the ESU/DPS most affected by artificial light and shading, even though the overall negative biological effect of artificial light or shading is minor.

ODFW has expressed concern not only for ESA-listed salmonids, but for other species of fish in the Project action areas. Such species occur in the identified Project action areas (which were defined based on the documented presence of ESA-listed fishes), and at Pipeline crossings where ESA-listed fishes are not known to occur. Appendix C (*Characteristics of Streams Crossed by the Pipeline*) illustrates the number of Pipeline action areas and the number of additional stream crossing locations that are expected to contain nonlisted fish during Project construction (listed by 4th field Hydrologic Unit Code). Numerous other crossings are expected to be dry during the in-water work window and would be accomplished using open-cut methods.

With the exception of species of concern, little site-specific information exists on native fishes in Oregon. Consequently it was not possible to calculate estimated direct and indirect take of these species.

State of Oregon sensitive species that are not ESA-listed or proposed that may occur in the Project areas include Coastal spring Chinook salmon ESU (listed as sensitive-critical), western brook lamprey (listed as sensitive-vulnerable), Pacific lamprey (listed as sensitive-vulnerable), coastal cutthroat trout (listed as sensitive-vulnerable), and Oregon coast winter steelhead (listed as sensitive-vulnerable). Southwest Washington Steelhead DPS occurs in the Clatskanie River and Lewis and Clark River systems crossed by the Pipeline, but is not listed by the state of Oregon as sensitive. Conservation measures and mitigation proposed for Oregon coast coho would also benefit coastal cutthroat trout, Coastal spring Chinook and Oregon Coast winter steelhead.

Pacific lamprey and western brook lamprey are unlikely to be negatively affected by Terminal construction and operation as they do not feed in the estuary, are not present during the in-water work window, and even though they are not as strong swimmers as salmonids, would be of large enough size to avoid entrainment by ballast and cooling water intake. Therefore, negative effects on species of lamprey would be restricted to non-HDD stream crossings. Direct effects from stream crossings primarily would be restricted to fish salvage and temporary displacement from the crossing locations. Habitat enhancements designed to be beneficial to ESA-listed salmonids should also mitigate negative Project effects on lamprey species.

The effects on coastal pelagic and west coast groundfish EFH species are discussed in Section 3.8 of the Applicant-Draft BA. Negative effects include larval entrainment, short-term turbidity increases during dredging, possible dredging entrainment and food-web effects, primarily to starry flounder and English sole. Detrital inputs from the mitigation area at the mouth of the Youngs River following reestablishment of tidal flow would benefit west coast groundfish with life history stages that utilize the LCRE. Because the negative effects on other coastal pelagic and west coast groundfish EFH species are relatively minor, no compensatory mitigation specific to these species is proposed. Measures discussed in the Applicant-Draft BA to avoid and minimize negative effects and the use of appropriate conservation measures during construction should be sufficient to ensure no net loss of EFH.

For reference purposes, other fish species that likely occur in the Project action areas are identified in Tables 5-6 and 5-7.

5.2.2 Compensatory Strategies and Measures

5.2.2.1. Goals and Objectives

The goal of the mitigation program is no net loss of either individual ESUs/DPSs or habitat function. To compensate for unavoidable fish take or habitat loss/degradation, compensatory mitigation is needed. Oregon LNG is committed to providing appropriate mitigation and has identified the following six primary actions to mitigate for expected effects on listed and proposed fish species and their habitats:

- Enhance approximately 140 acres of estuarine wetland habitat in Youngs Bay near the mouth of the Youngs River, through dike breaching and access to historical sloughs.
- Complete a minimum of eight fish barrier removal waterbody and riparian mitigation projects and executing those projects through a preferred provider, such as The Freshwater Trust or similar nonprofit organization.
- Complete wetland mitigation at the Nehalem River property, which would reconnect an historical oxbow that currently traps juvenile Oregon Coast coho (OC coho) after subsidence of high water events.
- Remove/replace road culverts that represent complete barriers to listed salmonids.
- Acquire and preserve approximately 1,000 acres (final area to be based on habitat effects determined during final engineering) in the Coast Range. Management for old-growth habitat and preservation would provide watershed-level ecological uplift to OC coho.
- Contribute to the long-term protection (through either conservation lease or purchase) of mature riparian habitat along one or more reaches of high-quality salmonid stream habitat.

A legal instrument is in place for Oregon LNG to use the Youngs River property site for mitigation, including an agreement for a long-term conservation easement as a condition of a deed restriction. There are provisions for supporting long-term maintenance and management including a revolving or endowment fund. Oregon LNG would prepare a long-term management plan that would be implemented by a third-party conservator.

Mitigation goals include the following:

- Breach an existing levee reconnecting 140 acres of historical floodplain along the Youngs River
- Restore anadromous fish rearing, migration, and refugia habitat in the lower Youngs Bay watershed;
- Create a low-maintenance and self-sustaining system.
- Maintain the safety of landowners behind the dike.
- Create estuarine wetland habitat for federally listed salmonids and other aquatic and terrestrial species
- Mitigation objectives include the following:

Restoring high and low tidal marsh wetland;

- Enhancing wetland hydrology by by sizing breaches to accommodate natural hydroperiod, tidal regime and peak flows;
- Adding habitat structure by providing woody debris;
- Reestablishment of self-sustaining native plant communities;
- Providing access to preferred rearing and refuge habitat;
- Providing aquatic species support by export of organic matter; and
- Increasing the quantity and quality of off-channel juvenile salmonid habitat for Youngs River salmonid populations by restoring off-channel habitat more than 2.5 miles.

5.2.2.2. Mitigation Measures

A description of each mitigation measure is provided below.

The proposed restoration or enhancement of approximately 140 acres of diked pasture land at the mouth of Youngs Bay is discussed in detail in Section 7.0, Wetlands. Salmonid habitat at this strategic site in Youngs Bay would be enhanced by opening the extensive area to juvenile salmonid access, restoring meandering historic channels within the property, and creating new channel habitat along historic tidal channels. Major access points for juvenile salmonids (dike breaches) into the marsh would be located where existing subtidal habitat in Youngs Bay is close to the existing dike. Hydrodynamic modeling conducted by Coast and Harbor Engineering determined that the property would become inundated twice each day at high tide, with inundation ranging from 40 percent to 50 percent of the time. No adverse effects on flow circulation, sediment transport, or morphology are expected. The site would be reconnected to tidal exchange (historical condition) and develop its own natural equilibrium based upon the actual tidal, riverine, and sediment processes following construction. The proximity of subtidal habitat is one of the factors that determine whether juvenile salmonids would utilize marsh habitat because they require nearby refuge during low tide conditions. After native freshwater marsh plants have recolonized the property, the marsh is expected to provide productive new rearing habitat for juvenile salmon that use Youngs Bay. In addition to providing food resources within the mitigation site, substantial quantities of macro detritus would be exported annually to enhance the estuarine detrital food web, which provides food resources to juvenile salmonids as well as a wide variety of nonlisted fish species.

Return of previously diked tidal areas in the LCRE has been shown to provide significant benefit to juvenile salmonids, and such projects have high restoration priority in the LCRE. Lessons learned from previous projects in the LCRE (Bonneville Power Administration [BPA] and USACE, 2013) include the following:

- Geographically larger projects provide more benefits than smaller ones.
- Projects closer to the Columbia’s main stem, making them more accessible to fish, are better than those farther away.
- Restoring remnant channels is better than excavating new ones.

- Natural processes are preferable to engineered processes.

The HYoungs River property and the proposed process for its restoration meet these criteria. At 140 acres, the Youngs RIver property is large in the context of reconnection sites; the property is close to the Columbia Mainstem; it has existing remnant channels that can either be restored by allowing them to reestablish naturally; and naturally processes would be allowed to regenerated the marsh following dike breaching.

In addition, much of the Youngs River property site has been identified as residing in the highest conservation score category (meaning it is a highly desirable site for restoration) by the Youngs Bay Bottomlands Conservation and Restoration Plan (Lev et al., 2006).

Tidal wetland restoration has been shown to be very effective in providing habitat for rearing juvenile salmonids. A 2009 review of restoration sites in the Lower Columbia River Estuary (LCRE) found that juvenile salmon either arrived where they had been absent or greatly increased in number (Johnson and Diefenderfer, 2010). In the Grays River, a tributary to the LCRE, Roegner et al. (2010) found that juvenile salmon quickly expanded into newly available habitat following the removal of tide gates from diked pastureland.

Haskell and Tiffan (2011) monitored a habitat project that reestablished about 94 acres of wetland and channel habitats at Crims Island and estimated 11,000 to 13,000 subyearling Chinook salmon used the site following restoration.

Several road culverts that represent complete migration barriers for adult salmonids would be removed or replaced with fish friendly culverts in selected ESUs/DPSs. Oregon LNG is committed to opening seven culverts before Project operation. Funding for three additional culvert removals/replacements would be provided post-operation to compensate for uncertainties in the impact analysis process or for any unanticipated effects that are identified through post operational monitoring. The seven culverts to be removed or replaced before construction would be located within the following ESUs/DPSs:

- Coastal Coho ESU – three culverts
- Snake River Fall-run (SRF) Chinook ESU – one culvert
- Lower Columbia River Coho – three culverts

These ESUs/DPSs have been identified through impact analysis as likely to be measurably impacted by construction or operation of the Project. The specific locations of the culverts to be removed or replaced have yet to be determined. Although specific culverts have not been identified for removal or replacement, the minimum criteria for culvert removal/replacement would be opening at least 1 mile of productive rearing and spawning habitat for the targeted ESUs/DPSs. Using agency-approved habitat survey methods, rearing and spawning habitat conditions upstream of each candidate culvert would be assessed and evaluated before final selection of culverts for removal/replacement. An estimation of the number of smolts produced as a result of the culvert replacements would be provided. Only sites that have high-quality spawning and rearing habitat for at least one mile upstream of the culvert would be selected. Agency agreement on the selected sites would be required. Oregon LNG would provide assurance to the resource agencies that it has acquired legal rights to remove or replace the culverts and that at least a 1-mile reach above each culvert would be protected from future degradation.

To mitigate, in part, for the long-term loss of LWD recruitment potential at Pipeline crossings, Oregon LNG would purchase conservation easements on riparian conifer stands to prevent selective cutting of mature trees within 100 feet of the stream edge. Locations would be identified within the range of each affected ESU (LCR Coho and Coastal Coho). Easements would be purchased on a 1:1 ratio. Based on the number of streams crossed with existing riparian vegetation, it is estimated that three to five miles (final mitigation to be based on habitat final habitat effects determined during final engineering) of riparian habitat would be protected in the Coast Range

Additional mitigation for long-term loss of LWD recruitment and other uncertainties associated with effects at Pipeline crossings of perennial streams would be provided through the acquisition of a large tract or tracts in the Coast Range. The primary objective of funding such acquisitions is to provide compensation for upland and riparian effects along the Pipeline corridor. However, an added benefit could be the acquisition of property that contains critical habitat of OC coho. To provide additional mitigation for effects on OC coho from salvage, a relict oxbow would be modified at the Nehalem River wetland mitigation site, adjacent to the Nehalem River, 1.7 river miles upstream of the HDD crossing at MP 33.5. A channel is choked with reed canary grass at the mitigation site. During high water events, the channel is flooded, and OC coho move into the channel. When the water recedes, the property owner has observed coho become stranded. Oregon LNG would remove the reed canary grass, enhance the current off-channel habitat, plant a mix of native vegetation, and deepen the connection with the Nehalem River to allow coho to exit the channel under all flow conditions. Additional detail is provided in Section 7.0.

5.2.2.3. Liquefied Natural Gas Carrier Water Withdrawals

The technical memorandum titled *Oregon LNG: Probabilistic Analysis of ESA-Listed Salmonid Entrainment at Ballast and Cooling Water Intakes* is provided in Appendix D of this Plan. The typical solution for minimizing the effect of water withdrawals is to place screens across the openings. NMFS and ODFW have specific criteria for screen mesh openings and approach velocities. Both NMFS and ODFW requested screening of the ballast and cooling water taken on by the liquefied natural gas carriers (LNGCs). The grates typically present on the LNGC sea chest intakes do not meet agency screening requirements for either mesh size or approach velocities during ballast water loading.

In order to outfit LNGCs with fish screens, approvals would be required from flag states, insurance companies, classification societies, vessel owners, vessel managers, technical managers, and ship Captains and Chief Engineers before a screening device could be placed on or in close proximity to a vessel's sea chests. While some portions of this approval process may be initiated before a vessel's charter for a particular voyage, the installation of a screening device on a particular vessel would be subjected to a multiagency permitting process immediately before the installation. After extensive investigation, there is no practical way to undertake this process for the potential of one to two import transits per year of tankers of unknown size or origin. USCG would not permit affixing and device to a ship that could impede an emergency exit from port. The absence of a defined regulatory process or any semblance of consensus among the various interested federal and state agencies on this issue makes it impracticable for Oregon LNG to comply with NMFS and ODFW recommendations to screen ballast and cooling water.

Even though take is expected to be less than that outlined in Appendix D (approaching zero) due to the transition from over 100 ships per year taking on ballast water to just two ships per year taking on ballast water, Oregon LNG is committed to ongoing coordination with federal and state agencies in developing strategies to minimize potential effects of ballast and cooling water intakes on listed species of fish. For example, the one or two import vessels per year, the transits that would be taking on ballast water, would mostly likely occur in the winter when peak demand for gas could not be met by existing pipeline sources. Winter import of gas would be past the peak time of salmon outmigration and therefore minimize the likelihood of entrainment in ballast water. Oregon LNG is proposing compensatory mitigation to offset the minimal take of fish in ballast and cooling water. The 140-acre Youngs River site at the mouth of the Youngs River, as well as riparian enhancement project, is proposed for mitigation of the ESUs most affected by ballast water withdrawals. Removal of barriers to fish passage, discussed in Section 5.2.2 above, is also proposed to compensate for potential entrainment of listed species of fish in ballast and cooling water.

5.2.3 Rationale for the Extent of Fish-Related Compensatory Mitigation

The degree of take resulting from certain effects is expected to be insignificant and restricted to behavioral modifications not leading to significantly decreased survival. Consequently, no compensatory mitigation is proposed for the following effects:

- Artificial light and shading
- Turbidity (from dredging, dredge disposal and Pipeline construction)
- Passage impediments (during Pipeline construction)
- Food web effects

The following effects are dependent on species and would require mitigation:

- Pile-driving noise
- Fish salvage at Pipeline crossings
- Habitat loss or alteration
- Loss of riparian vegetation
- Dredging entrainment (only if a hopper dredge is used)

The severity of Project effects, and thus the need for compensatory mitigation depends, at least in part, on the duration of Project effects. Table 5-4 summarizes the duration of each “mitigatable” Project effect.

As discussed in Section 3.8 of the Applicant-Draft BA, negative effects on many of the ESUs are minor, and would be addressed through minimization, avoidance, and BMPs. This results in the need for mitigation for only a subset of the ESA-listed species present in the Project action areas. Table 5-5 illustrates the proposed mitigation by ESU/DPS species. Proposed mitigation on a per ESU/DPS basis is discussed in Sections 5.2.3.1 through 5.2.3.11 below.

Mitigation efforts for the unavoidable effects are concentrated within the ranges of the specific ESUs/DPSs.

5.2.3.1. Upper Columbia River Steelhead, Upper Willamette River Steelhead, Lower Columbia River Steelhead, Middle Columbia River Steelhead and Snake River Basin Steelhead

Based on ballast water entrainment modeling, steelhead are minimally susceptible to entrainment, and therefore take resulting from entrainment would be essentially zero. Likewise, dredging and disposal are unlikely to entrain steelhead. Because steelhead move through the estuary very quickly, their utilization of the affected habitats is expected to be minor and the extent of unquantified take would be insignificant. Because the degree of direct and indirect take is expected to be so low, no compensatory mitigation is proposed. However, these DPSs could benefit from macro detritus production exported from the Youngs River Mitigation Site.

5.2.3.2. Snake River Sockeye

As with steelhead, sockeye salmon were shown not to be susceptible to ballast and cooling water entrainment, or dredging and disposal entrainment and therefore take due to entrainment would be essentially zero. Because Snake River sockeye move through the estuary very quickly, their utilization of the affected habitats is expected to be minor and the extent of unquantified take would be insignificant. Because the degree of direct and indirect take is expected to be so low, no compensatory mitigation is proposed.

5.2.3.3. Upper Columbia River Spring-Run Chinook

Because of their stream-type life history, spring-run Chinook, like steelhead and sockeye, are minimally susceptible to dredge and dredge disposal entrainment and entrainment due to ballast and cooling water withdrawal was estimated at much less than one juvenile salmonid. Upper Columbia River Spring-run Chinook move through the estuary very quickly, their utilization of the affected habitats is expected to be minor, and the extent of unquantified take would be insignificant. Because the degree of direct and indirect take is expected to be so low, no compensatory mitigation is proposed. However, this ESU could benefit from macro detritus production exported from the Youngs River Mitigation Site.

5.2.3.4. Snake River Spring/Summer Chinook

It was estimated that 0.01 – 0.07 Snake River Spring/Summer Chinook could be entrained in ballast and cooling water annually for an import only Terminal. This number is expected to be at least an order of magnitude lower for a bi-directional Terminal. Because Snake River Spring/summer Chinook are stream-type fish that migrate rapidly through the estuary, their utilization of the affected habitats is expected to be very minor and the extent of take due to habitat alteration would be insignificant. Thus, no compensatory mitigation is proposed. However, this ESU could benefit from macro detritus production exported from the Youngs River Mitigation Site.

5.2.3.5. Lower Columbia River Chinook

It was estimated that from 3.62 to 13.81 LCR Chinook juveniles could be entrained in ballast and cooling water annually for an import only Terminal. This number is expected to be at least an order of magnitude lower for a bi-directional Terminal. A total of 185 could potentially be present in the “harm” zone during pile driving. This is by far the greatest effect on any ESU from pile-driving noise. In addition, LCR Chinook may be most susceptible to dredging entrainment due to their longer period and estuarine utilization and their small size during estuarine residency, but this is mitigated by the fact that they tend to be found in shallow edge habitats, and not at the depths to be dredged. As ocean-type fish, LCR Chinook likely utilize the LCRE for rearing more than any of the other ESUs and therefore would be most negatively affected by habitat alterations and other unquantified forms of take. LCR Chinook are also present in streams crossed by the Pipeline. However, the rivers and streams containing LCR Chinook habitat would be crossed using HDD methods and therefore no mitigation is proposed for habitat effects at the Pipeline crossing locations.

Mitigation is proposed to compensate for the one-time loss of 185 juvenile LCR Chinook due to pile-driving noise and the annual loss of 4 to 14 juvenile LCR Chinook due to ballast and cooling water withdrawal.

Proposed Mitigation

The proposed Youngs River Mitigation Site at the mouth of the Youngs River would provide preferred shallow water rearing habitat for far more than 185 juvenile LCR Chinook potentially taken during construction and would provide rearing habitat for many more than the 14 juveniles potentially taken annually. This rearing habitat would be available daily throughout the year and would export organic material that would benefit ESA-listed salmonids that do not directly utilize the shallow water and channel habitat to be reopened at the mitigation site.

5.2.3.6. Upper Willamette River Chinook

It was estimated that 0.04 to 0.28 Upper Willamette River (UWR) Chinook could be entrained in ballast and cooling water annually for an import only Terminal. This number is expected to be at least an order of magnitude lower for a bi-directional Terminal. UWR Chinook have both ocean-type and stream-type life histories and could also be affected by habitat changes to the LCRE, although the degree of negative effects is expected to be minor. Because the level of annual take is expected to be so low, no mitigation is proposed beyond that provided primarily to the ocean-type component of this ESU at the Youngs River Mitigation Site. Enhanced rearing opportunities at the proposed mitigation site should more than offset the very small amount of take from ballast water withdrawal.

5.2.3.7. Snake River Fall-run Chinook

It was estimated that 0.15 to 0.56 SRF Chinook could be entrained in ballast and cooling water annually for an import-only Terminal. This number is expected to be at least an order of magnitude lower for a bidirectional Terminal. It was also estimated that three SRF Chinook could potentially be in the “harm” zone during pile driving. SRF Chinook historically had an ocean-type life history and could also be affected by habitat changes to the LCRE, although the degree of negative effects is expected to be minor, and the majority of SRF Chinook currently adopt a reservoir-rearing life style.

Mitigation would be conducted for habitat effects in the LCRE and for the direct losses due to ballast/cooling water withdrawal and pile-driving noise.

There is currently only one population of SRF Chinook: the Lower Snake River Mainstem population. This population occupies the Snake River from its confluence with the Columbia River to Hells Canyon Dam, and the lower reaches of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon Rivers (NMFS, 2005). Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon Dam, the lower reaches of the Imnaha, Grande Ronde, Clearwater, and Tucannon Rivers, and small mainstem sections in the tailraces of the lower Snake River hydroelectric dams (Good et al., 2005). Dams and alterations in river flow and temperatures from various water uses in the upper Snake River and tributaries are the primary continuing threats to fall Chinook salmon range and habitat (NMFS, 2005).

Proposed Mitigation

Oregon LNG proposes to complete one culvert removal/replacement project within the range of SRF Chinook. Because the Imnaha River contains spawning habitat and is located in Oregon, culvert removal/replacement efforts would focus on the Imnaha River unless ODFW or other agencies/nongovernmental entities identify higher priority culverts outside the Imnaha Basin.

Redd counts in the Imnaha basin are highly variable and thus determining the likely effect of a culvert replacement would be very site specific. However, if suitable habitat is present (a requirement of any culvert replacement) and spawning adults are present downstream, it is reasonable to assume that at least one redd would be occur in a mile of additional spawning habitat. If egg to smolt survival ratio is assumed to be 0.104 for Chinook (Quinn, 2005), an additional five eggs would be required to replace the maximum of 0.56 juveniles lost annually. Assuming fecundity of 8,000 eggs per female (Scott and Crossman, 1973), opening up spawning habitat to even one additional pair of SRF Chinook would more than replace the juveniles lost to ballast and cooling water entrainment.

There is also an ocean-type component of the SRF Chinook population that would benefit from increased rearing opportunities at the Youngs River Mitigation Site. Thus, the proposed mitigation site would compensate for any direct take due to ballast and cooling water entrainment or noise effects by providing additional productive rearing habitat.

5.2.3.8. Lower Columbia River Coho

It was estimated that 0.22 to 1.19 LCR coho could be entrained in ballast and cooling water annually for an import only Terminal. This number is expected to be at least an order of magnitude lower for a bi-directional Terminal. However, it is unlikely that LCR coho rear extensively in the LCRE, and therefore there would be few, if any, negative habitat effects in the estuary. Additionally, LCR coho are present at seven HDD stream crossings, and at or immediately downstream from eight flume or open-cut crossings that would use flume methods if they contain water at the time of construction.

Juvenile coho density information is available from the Salmon Recovery Data Tracker website (http://odfwrecoverytracker.org/). Of the streams where LCR coho may be present, the Clatskanie River, Little Clatskanie River, Merrill Creek Tributary and Milton Creek have all been surveyed by ODFW at least once since 1998. For these streams, the mean density of all samples was used to estimate the number of LCR coho potentially affected. For streams where there has been no sampling by ODFW, the mean density of all sampled sites over all years (0.09 juvenile salmon/square meter) was used. For the portion of habitat affected at each crossing that was not pool, coho density was assumed to be half that of pool habitat. It was assumed that 60 feet of waterbody would be isolated by cofferdams during construction and would require salvage. Stream sizes crossed and the number of LCR coho likely affected are provided in Table 5-6. Data on stream size were obtained from CH2M HILL habitat surveys.

Using this method of estimation, 58 LCR Coho are expected within the flumed stream crossing isolation areas. Of course, this number could be higher or lower depending on the productivity of the year salvage occurs. Assuming 3 percent mortality of salvaged fish, one or two would likely die as a result of electrofishing. Therefore, salvage would result in the loss of up to two and the harassment of 58 LCR coho.

Based on the nature of the effects, mitigation would be conducted to offset losses due to fish salvage and reduced LWD recruitment potential.

Proposed Mitigation

The LCR Coho ESU includes 25 populations that historically existed in the Columbia River basin from the Hood River downstream. Eight of these populations are present in Oregon: Youngs Bay, Big Creek, Clatskanie River, Scappoose Creek, Clackamas River, Sandy River, Lower Gorge and Hood River/Upper Gorge. Although LCR coho can, and in some years do, occur in areas crossed by the Pipeline, previously, NMFS concluded that all natural populations outside the Sandy and Clackamas rivers were probably extinct, and since the mid-1970s there has been no natural reproduction in the Clatskanie River during most years (PSU, 2001). However, in recent years the number of coho in the Clatskanie River system has increased. In 2011, the estimated number of coho spawning in the Clatskanie River was 1,553, of which only 3 5 were hatchery origin (Lewis et al., 2012). Mitigation would be focused on the local populations in Youngs Bay, the Clatskanie River, and Scappoose Creek, all of which are at high risk of extinction based on a number of factors (McElhaney et al., 2007). Spatial structure has likely been reduced by habitat degradation, particularly in valley floor habitats of the lower basin. Habitat changes in the Columbia mainstem and estuary also likely have a significant effect on coho salmon (*ibid*). Although coho exhibit a primarily stream-type life history, recent research indicates that so called "nomads"—historically considered excess fry that moved downstream either due to disturbance (high flows) or density dependent factors—can adapt to brackish water and may rear in estuarine environments before moving back into freshwater to overwinter (Koski, 2009). Therefore, the Youngs River Mitigation Site at the mouth of the Youngs River could provide rearing habitat for LCR coho "nomads."

To compensate for salvage losses Oregon LNG would conduct three culvert removal/replacement projects. Opening up one mile of habitat should more than compensate for the one-time loss from salvage. Culvert removal/replacement project selection would be conducted as described in Section 5.2.2. In order to compensate for the loss of LWD recruitment potential due to removal of riparian vegetation, Oregon LNG would purchase conservation easements (as described in Section 5.2.2) on a 1:1 replacement ratio. Of the flume crossings within the range of LCR coho, only Hackard Creek, Milton Creek, Merrill Creek and its Tributary have intact woody riparian zones, and therefore, purchase of riparian conservation easements would result in the long-term protection of 300 feet of riparian vegetation.

5.2.3.9. Oregon Coast Coho

OC Coho do not occur in the Terminal location and would therefore only be affected by Pipeline construction and operation. OC coho are present at five HDD stream crossings, and at or immediately downstream from five flume crossings.

The population affected is the Northern Oregon Coast, Nehalem River population, which is the fourth largest of 21 populations. Therefore, mitigation would occur only within the geographic boundaries of the population. As reported in the Applicant-Draft BA, limiting factors include stream complexity and water quality.

Salvage at the flume crossings would negatively affect some OC coho. Juvenile coho density information is available from the Salmon Recovery Data Tracker website (http://odfwrecoverytracker.org/). Of the streams where OC coho may be present, Alder Creek, Rock Creek, Clear Creek, and Cedar Creek have all been surveyed by ODFW at least once since 1998. For these streams, the mean density of all samples was used to estimate the number of OC coho potentially affected. For streams where there has been no sampling by ODFW, the mean density of all sampled sites over all years (0.37 juvenile salmon/square meter) was used. For the portion of habitat affected at each crossing that was not pool, coho density was assumed to be half that of pool habitat. It was assumed that 60 feet of waterbody would be isolated by cofferdams during construction and would require salvage. Stream sizes crossed and the number of OC coho likely affected (based on their average density) are displayed in Table 5-7.

Using this method of estimation, 178 OC Coho are expected within the flumed stream crossing isolation areas. Of course, this number could be higher or lower depending on the productivity of the year salvage occurs. Assuming 3 percent mortality of salvaged fish, five fish would likely die as a result of electrofishing. Therefore, salvage would result in the loss of up to five and the harassment of 178 OC coho.

Proposed Mitigation

In order to compensate for salvage losses, Oregon LNG would conduct three culvert removal/replacement projects. Culvert removal/replacement project selection would be conducted as described in Section 5.2.2.

It is assumed that replacing three culverts would result in at least one redd within the additional mile of spawning habitat. If egg to smolt survival ratio is assumed to be 0.018 for coho (Quinn, 2005), an additional 7,055 eggs would be required to replace the 127 juveniles potentially affected by salvage. Assuming fecundity of 3,000 eggs per female (Scott and Crossman, 1973 – range reported to be 1,440 to 5,700 eggs per female in Washington), opening up spawning habitat to even three additional pairs of OC coho would replace the juveniles affected by salvage. Opening up spawning habitat to one pair would far exceed the projected lethal take due to salvage.

To compensate for the loss of LWD recruitment potential due to removal of riparian vegetation, Oregon LNG would purchase conservation easements as previously described on a 1:1 replacement ratio.

Of the flume and open-cut crossings within the range of OC coho, Alder Creek, Rock Creek, N. Fork Wolf Creek, and Clear Creek currently have riparian zones with woody vegetation. The purchase of riparian conservation easements to mitigate for the loss of LWD recruitment would result in the long-term protection of 300 feet of riparian vegetation.

To further compensate for habitat loss and unforeseen negative effects, Oregon LNG would acquire upland habitat that is managed as industrial timberland with riparian and stream components in the landscape. Preserving upland and riparian habitat and eliminating 40- to 60-year harvest regimes on large tracts of land would be beneficial to stream and fish habitat. Wetland restoration at the Nehalem River property is designed to eliminate entrainment of OC coho in reed canary grass.

5.2.3.10. Green sturgeon

Because of their large size, and the timing of their estuarine residency, green sturgeon are expected to be little affected by any Project activities. The only potential effect would be removal and burial of a small amount of food organisms during dredging and dredge disposal. Green sturgeon populations are unlikely to be limited by food availability. No compensatory mitigation is proposed. However, there would likely be some food-web benefit to green sturgeon from the Youngs River Mitigation Site.

5.2.3.11. Eulachon

Eulachon do not occur in any of the streams to be crossed by the Pipeline, except for the HDD crossing of the Columbia River. The proposed spring to fall dredging period restricts the negative effects of dredging entrainment to a few late drifting larvae in the spring, rather than having a dredging period that completely overlaps eulachon upstream and downstream movements. Because eulachon do not utilize food organisms that would be affected by the Project, negative effects would be restricted to ballast and cooling water entrainment during the period when larvae are present. Because larval mortality is so high and because ballast and cooling water operations would affect only a very small fraction of the water in the LCRE, no effect on eulachon populations is anticipated and no compensatory mitigation is proposed.

5.2.3.12. Nonlisted Species

Pacific Lamprey

Direct effects from stream crossings primarily would be restricted to fish salvage and temporary displacement from the crossing locations. Pacific lamprey salvage would be conducted using low pulse-rate electrofishing gear proven to be effective for lamprey ammocoete collection. Culvert replacement or removal designed to be beneficial to ESA-listed salmonids should also mitigate negative Project effects on lamprey species. Pacific lamprey are likely to be present downstream from culvert replacement or removal locations, and therefore the cumulative benefit to lamprey would be greater than to any listed ESU/DPS.

Nonlisted species would be negatively affected by direct and indirect effects in the LCRE and at Pipeline crossings. Negative effects in the LCRE include larval entrainment, short-term turbidity increases during dredging, possible dredging entrainment and food-web effects. These negative effects on the LCRE would be mitigated by detrital inputs from the Youngs River Mitigation Site at the mouth of the Youngs River following reestablishment of tidal flow and the creation of shallow water habitat at the dredge disposal sites.

“Mitigatable” effects on nonlisted species at Pipeline crossings would include fish salvage and loss of LWD recruitment potential. Fish salvage is difficult to quantify, as the populations of the various nonlisted species is effectively unknown. However, based on the relatively large and nonthreatened nature of these populations, losses due to salvage are expected to be biologically insignificant. To replace the lost LWD recruitment potential, Oregon LNG would purchase conservation easements along 3 to 5 miles (to be based on habitat effects during final engineering) of stream in the Coast Range as previously described.

5.2.4 Mitigation Project Lists

To create a positive effect on species survival and recovery, mitigation would be directed by knowledgeable local agency personnel and would focus on areas where the “most bang for the buck” can be achieved. ODFW issued a 2013 list of priority passage projects. Those in the Nehalem, Lower Columbia, and Lower Columbia-Clatskanie are listed in Table 5-8. ODFW has created a 2013 priority list that identifies priority passage projects throughout the state. Priorities would change as projects get completed and therefore it is impossible to identify specific projects until Oregon LNG receives all necessary construction authorizations. Nonetheless, Table 5-8 was constructed to illustrate the abundance of available projects that could be identified that achieve stated mitigation goals. Projects would be executed in a manner consistent with ODFW design criteria and standards. Oregon LNG is committed to completing a minimum of eight fish barrier removal projects. Projects would be selected relative to direct take of listed fish by ESU. Project selection could be accomplished by focusing on alleviating limiting factors, restoring those populations that are most at risk, or implementing high-priority restoration activities. Oregon LNG is interested in using The Freshwater Trust or a similar conservation organization in executing stream and riparian mitigation projects.[11] The Freshwater Trust has a tool, StreamBank, that can be modified for use as the online tool to communicate with the Adaptive Management Team, tracking projects from design through performance monitoring.

In addition to the stream projects listed in Table 5-8, one large mitigation area is proposed to mitigate the negative effects caused by construction and operation of the Terminal. The Youngs River Mitigation Site would return currently diked tidal flat to tidal hydrology on 100 acres at the mouth of the Youngs River,

5.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

5.3.1 Pipeline

5.3.1.1. Stream Crossings

Stream banks would be restored according to plans submitted in the Applicant-Draft BA. Stream bank restoration would be monitored after construction to ensure that bank stabilization methods employed were effective.

Should channel subsidence, bank erosion, channel scour, or other negative long-term effects of Pipeline construction become apparent during post-construction monitoring, case-specific responses would be tailored to alleviate the specific problems identified.

Restoration procedures would be monitored to ensure their efficiency and effectiveness. If the monitoring identifies any areas of erosion or ineffective revegetation, the easement would be restored in accordance with the existing plans unless it is determined that modified plans are needed, in which case NMFS and ODFW would be contacted for approval of any such modifications. Sediment barriers would be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls, or until restoration of adjacent upland areas is complete and revegetation has stabilized the disturbed areas.

After initial revegetation, a monitoring plan would be implemented to ensure successful reestablishment over the long term. The monitoring plan has not yet been developed, but it would be completed and approved by ODFW and DSL before consultation begins. It would provide for a minimum of 5 years of monitoring.

5.3.1.2. Ongoing Vegetation Removal

Disturbances due to continued maintenance include the effects of mowing, road maintenance, and herbicide use. The proposed long-term revegetation plan is described in Section 3.5.3 of the Applicant-Draft BA. Revegetation measures would be implemented following the FERC Plan and Procedures. Maintenance mowing and vegetation removal would be kept to the minimum necessary to satisfy Pipeline inspection and maintenance requirements.

Mowing

Maintenance of the Pipeline would include periodic vegetation mowing, as necessary and in accordance with the FERC Plan and FERC Procedures, to allow for visual Pipeline inspections. At stream crossings, the mowed area would be 10 feet. This corridor of permanent maintenance would experience a change in condition. However, the

[11] Identifying The Freshwater Trust as the preferred provider for stream and riparian mitigation does not constitute an endorsement of the Project by this conservation organization.

objective of riparian restoration, as shown in Figure 5-2, is to create a dense canopy so that, over time the effects from construction would be insignificant to ESA-listed fish species and their habitat.

Access Road Maintenance

Equipment such as "brush-hogs" that may be required for controlling vegetation would access the Pipeline on the existing access roads and the new road sections discussed above. The equipment would not cross streams that support ESA-listed fish where bridges do not currently exist. If necessary, workers would clear vegetation on foot.

In the unlikely event that repairs are needed at Pipeline crossings, the repair access approach would be the same as that described for the original construction. Pipe installed using HDD methods would not be removed under any circumstances. If a pipe at an HDD crossing were to fail, a new pipe would be installed using HDD methods, rather than attempting a repair.

Herbicide Application

Herbicide application may be required for the control of natural vegetation or invasive species, such as Himalayan blackberry, in Pipeline easements. However, to preclude herbicide drift into sensitive streams or waterbodies, no herbicides would be applied unless absolutely necessary; and, if application becomes necessary, herbicides would not be applied within 100 feet of a wetland or waterbody, unless approved by appropriate federal and state agencies. In the event that herbicide application proves necessary, specific usage guidelines would be prepared in consultation with regulatory agencies to ensure that existing conditions are maintained.

5.3.1.3. Human Access

During regular Pipeline maintenance activities, any evidence that the public is using the corridor to access otherwise inaccessible areas would be noted. In the event that maintenance of the Pipeline corridor does lead to unintended use by the public, steps would be taken to curtail this use by concealing and blocking any trails that develop with logs, rootwads, or boulders; posting "no trespassing" signs; or taking other actions as appropriate. Existing conditions are expected to be maintained. The intent is to prevent motorized vehicles from unauthorized use that could create rutting that leads to erosion. Landowners may permit access for passive recreation or hunting. Terms of human use and use by landowners would be defined in the easements that are obtained by Oregon LNG.

5.3.2 Terminal

5.3.2.1. Long-Term Effects of Dredging

Habitat Modification

Construction would result in the conversion of 0.04 acre of shallow water habitat to deepwater habitat. Compensatory mitigation is proposed to replace this lost habitat. The ecological functions would be replaced by the functional uplift at the Youngs River property mitigation site.

Hydrology

Hydrodynamic modeling conducted by Coast & Harbor Engineering (2009a) indicates that the hydrology of the LCRE would not be significantly modified from its current state and therefore no conservation measures are necessary.

Salinity and Temperature

Hydrodynamic modeling indicates that the temperature and salinity of the dredge prism would not be significantly modified from their current state and therefore no conservation measures are necessary.

5.3.2.2. Artificial Light

In practice, the available methods for avoiding and minimizing light effects are constrained by the fact that minimum light requirements for safety and security are often set by industry standards. The minimum amount of light necessary to complete construction and operation tasks would be used, and lighting would be directed to work areas in order to minimize stray light. Light sources would also be located as close as possible to critical instruments, such as gauges, so that additional general lighting is unnecessary.

Lighting at the Terminal and onshore facilities would likely include a mixture of low-power fluorescent lighting and higher intensity security lighting. Measures to minimize the potential for lighting effects on fish resources include (a) the use of directional lighting facing onshore to the extent possible, (b) the use of screens or lighting hoods, (c) the use of motion-activated lighting, (d) the use of full-cutoff light fixtures, which have no direct uplight, help eliminate glare, and are more efficient by directing lighting down to the intended area only, and (e) the planting of vegetation along shorelines to screen open-water areas from operating lights.

While some lighting would be required at all times on the pier and access trestle, more intense light would be required during unloading operations, a maximum of 2 days during those weeks when a LNGC is scheduled to arrive. Throughout the planning process for the Terminal, NMFS and USFWS would be consulted for input into light minimization and mitigation methods.

5.3.2.3. Attraction of Avian Predators

To prevent birds from roosting on the pilings, the tops of the pilings would be capped with cones designed to prevent roosting. As part of their training, facility employees would be instructed to report any observations of birds habitually using facility structures for roosting. During regular inspections and other activities mandated by safety and security requirements, a designated employee would be charged with monitoring to determine whether other structural components of the mooring pier or access trestle are being used as roosting sites for avian predators. Any signs of persistent avian roosting would be recorded, and during the first year of operations a report would be filed with designated ODFW and NMFS offices every 6 months. Thereafter, an annual report would be filed. If, after 2 years, no avian predators have been observed, reporting would cease but monitoring would continue.

In the event that predatory birds begin using the platform, Terminal, or access trestle, an adaptive management plan would be implemented in consultation with local ODFW biologists to prevent roosting. Potential exclusion methods would vary, depending on the bird species involved and the specific roosting locations. Possibilities include wire mesh or netting to exclude birds from enclosed spaces; metal prongs, needle strips, or porcupine wires installed on horizontal roosting surfaces; sticky bird gel repellents; automated water spray deterrent devices; spaced overhead wires (similar to those described in Steuber et al., 1993); or other methods suggested by wildlife biologists. These methods may constitute “harassment” under the Migratory Bird Treaty Act (MBTA), and before implementation, any management plan would be submitted to USFWS for comment. In the unlikely event of nesting on facility structures, nests would be removed immediately upon discovery. If a nest becomes established and it is not discovered until young birds are present, the disposition of the nest would be handled in accordance with the provisions of the MBTA. The implementation of these preventive measures, long-term monitoring, and adaptive management plans are expected to ensure that existing conditions regarding avian predation of listed species are maintained.

5.3.2.4. Shading

The effects of shading have been minimized through conscientious siting and design of the pier and access trestle (e.g., situating the longest axis of the trestle in an east-west configuration, positioning of the trestle relatively high above the water surface) and use of grated steel decking. No additional conservation measures are proposed.

5.3.2.5. Potential LNG Spills

The potential for LNG spills is greatly reduced by numerous design and security measures, including multi-walled tanks, secondary containment of piping and onshore tanks, and leak detection equipment. If a spill were to occur, the effects on fish and fishery resources would be minor, localized, and short term. It is expected that existing conditions would be maintained.

5.3.2.6. Hazardous Materials Release

The SPCC Plan is found in Appendix B. Careful adherence to this plan and consistent implementation of preventive measures would ensure the maintenance of existing conditions.

5.3.2.7. Maintenance dredging

The conservation measures described above for the initial dredging of the berth and turning basin would be implemented during periodic maintenance dredging.

5.3.2.8. Terminal Water Discharges

Impervious surfaces have been reduced to the maximum degree through conscientious site design, thereby avoiding and minimizing the potential effects from surface runoff. Conservation measures for the stormwater and fire suppression testing water include the conscientious implementation of the stormwater plan. Stormwater would be transported to the City of Warrenton POTW. Fire suppression water would be obtained from the Skipanon River and would drain back into the river after each test.

5.3.2.9. Prop Wash

The shoreline would be monitored for the first five LNG deliveries and thereafter at least once every 90 days (quarterly). Should the monitoring determine that potentially damaging erosion is occurring as a result of operations (rather than from significant storms or natural wave action) and that stabilization measures would reduce erosion potential, appropriate measures would be implemented pursuant to federal and state removal/fill approvals. In the event that monitoring indicates shoreline erosion, then soft armoring techniques, such as vegetation and brush layering, would be employed as an adaptive management strategy Period bathymetric surveys would be conducted concurrent with surveys to establish the necessity of maintenance dredging. Should bathymetric surveys indicate slope erosion, adaptive management would be conducted in consultation with USACE. Slope armoring or disposal of dredged material could be employed to arrest any slope erosion that does occur.

5.3.2.10. Introduction of Exotic or Invasive Species

Like other cargo vessels, LNGCs would be required to follow the ballast water management rules laid out in OAR 340-143-0001. The Oregon rules are generally congruent with USCG regulations. The ballast water program is administered by ODEQ, and under the rules, a vessel may discharge ballast within waters of the state only if:

- The vessel has conducted an open ocean exchange (at least 200 nautical miles [nm] from shore and in waters at least 2,000 meters deep); or
- A coastal exchange of ballast water has been performed (at least 50 nm from shore and in waters at least 200 meters deep) for vessels on coastal voyages traveling to Oregon from a North American coastal port south of 40°N or north of 50°N; or
- The vessel discharges ballast water that has been treated to remove organisms in a USCG-approved manner; or
- Conditions are such that without performing an exchange, the exchange would be unsafe or infeasible because of adverse weather, vessel design limitations, or equipment failure.

Vessels are also required to file ballast water management reports to ODEQ at least 24 hours before entry into the state. These measures should greatly reduce the likelihood of exotic species introductions via ballast water.

5.3.3 Adaptive Management Summary

As described in Sections 3.5 and 3.6 of Oregon LNG's Applicant-Draft BA, construction and operation of the Project has the potential to affect listed fish through a number of direct and indirect pathways. Where direct effects on listed species are anticipated (i.e., mortality, harm or harassment), estimates of potential take have been provided in the Applicant-Draft BA. Indirect effects have also been described but are more subjective and have been estimated with less precision. These estimates of direct and indirect effects provide the targets (expected values or ranges of values) for assessment through monitoring. At the Terminal, monitoring programs would be developed for turbidity generated during construction dredging, maintenance dredging and dredged material disposal; underwater noise; propwash/bow thruster effects on shoreline structures; and for avian predator use of pier and trestle structures.

Also at the Terminal, monitoring would be conducted to validate modeling results for potential entrainment of fish in ballast and cooling water. The validation work would be conducted before commencement of Terminal operations. Potential methods of validation under consideration include surveying the density and location of fish in the water column, pumping water through a face plate with an opening similar in size as might be expected on an LNG tanker; or the use of a surrogate ship with intakes at depths similar to an LNG tanker. The fish survey approach would validate two of the main variables affecting the results of the entrainment modeling study. The face plate and pump mechanism would be tested by hanging the test apparatus at an appropriate depth from a barge. The method and timing of the validation study would be coordinated with the NMFS and ODFW before commencement of the study. The quantity of compensatory mitigation for direct take of fish may be adjusted, but no less than currently proposed, based on the results of the validation study.

At stream crossings along the Pipeline route, construction and operation effects primarily involve effects on instream, bank and riparian habitat conditions rather than direct mortality, harm or harassment to listed fish species. The adaptive management plan for listed fish at stream crossings therefore, is described in Section 8.0, Stream Channels and Waterbodies.

For the Terminal, adaptive management plans would be developed for turbidity, underwater noise, avian predation, prop and bow thruster wash and ballast/cooling water entrainment. The following summaries provide suggested adaptive management strategies for each of the Terminal effects that require monitoring:

- Water quality effects associated with turbidity generated during dredging and dredge material disposal.
  - The monitoring requirements and location of monitoring sites downstream from dredging activities can vary somewhat from project to project, depending on site conditions. The following is based on typical requirements for maintenance dredging in the LCR and may not represent the specific requirements that ODEQ would specify for this Project.
  - Clamshell dredging would be used to dredge material from the berth and turning basin. Turbidity monitoring would be conducted throughout the hydraulic dredging operation at ODEQ-specified intervals (usually 4-hour intervals). A turbidity exceedance occurs when turbidity measured downcurrent (usually 300 feet downstream) from the dredge cutter head exceeds 10 percent over background. If an exceedance is detected, the dredge captain would be notified and modifications to the dredging process would be made to reduce the turbidity-causing activity. Modifications could include reducing the rate of swing of the cutter head and/or reducing the rate of pumping. A second monitoring event would then performed two hours later. If turbidity exceeds 5 NTU over background (when background is less than 50 NTU) during the second monitoring interval, the turbidity-causing activity would be stopped until turbidity levels return to background levels measured during that monitoring event. At that point, sampling would be continued at 4-hour intervals during active dredging operations. If continued exceedances occur, the dredging may be shut down until a satisfactory solution can be achieved to ensure that turbidity criteria are not exceeded.
  - Material dredged by clam shell dredging would be transported by barge to the dredge disposal sites and bottom-dumped at the disposal sites. Because of the short-term nature of the turbidity plume generated by the dumping process, it is not likely that adaptive management would be required for turbidity compliance at the disposal sites. However, bathymetric surveys would be conducted to document that the placement of material is located where it is supposed to be.
- Underwater noise effects
  - Monitoring and the adaptive management strategies for reducing excessive underwater noise are described in Applicant-Draft BA Appendix 8, *Oregon LNG Terminal and Oregon Pipeline Project—Underwater Noise, Propagation, Monitoring, and Mitigation*.
- Avian predation

  - Avian predators such as cormorants often use piers and pilings for perching and roosting. Bird predation on juvenile salmonids could increase if the proposed wharf and trestle were used as a preferred perching or roosting site. Monitoring would be conducted to determine whether the wharf and trestle are used by avian predators. If a problem is identified, adaptive management would be implemented to either make the wharf and trestle unattractive for roosting or perching or by employing methods that would scare the birds from the site. The scientific literature would be reviewed to determine what techniques have been used successfully in the past. One or more of these techniques would be selected and tested through continued monitoring. If the first technique is unsuccessful, additional techniques would be tested until a satisfactory solution is found.

- Prop wash and shoreline erosion
  - Hydrodynamic modeling indicated that propwash from tugboats and LNGC main propeller would not result in bottom scour even for the most conservative scenarios. However, LNG bow thrusters may potentially generate dredged slope scour for extreme docking conditions. Although it is unlikely that such scour would result in significant effects on turbidity or physical habitat conditions, bathymetric monitoring would be conducted periodically to ensure that the conclusions of the hydrodynamic modeling are correct. If excessive erosion is identified, adaptive management would be implemented. Possible solutions may include changes in the departing procedures for the LNGCs or hardening the substrate (e.g., placement of coarse sand) at the site of erosion.

- Ballast and cooling water
  - Oregon LNG proposed compensatory mitigation commensurate with take modeled for entrainment in ballast and cooling water. As an adaptive management strategy, Oregon LNG is committed to adjusting the amount of mitigation that may be performed following analysis of the results of the ballast and cooling water study. Mitigation may include opening up additional new spawning and rearing habitat through culvert removals or enhancement of degraded spawning and rearing habitat. Any such mitigation would be directed toward increasing production of juveniles in affected ESUs and would require monitoring to ensure that the expected increases are realized.

SECTION 6
Habitat Types and Vegetation

ODFW evaluates Project effects according to ODFW's Habitat Mitigation Policy. This policy was written to standardize analyses and provide goals for the mitigation of effects resulting from development actions that may have an effect on fish and wildlife. The state policy is modeled on USFWS Mitigation Policy (46 Fed. Reg. 7644-7655, Jan. 23, 1981) established in accordance with the Fish and Wildlife Act of 1956 (16 *United States Code* [USC] 742(a)-754), the Fish and Wildlife Coordination Act (16 USC 661-667(e)), the Watershed Protection and Flood Prevention Act (16 USC 1001-1009), and the National Environmental Policy Act (42 USC 4321-4347). During preliminary consultations with ODFW and USFWS, a verbal agreement was made to follow the guidelines in the state policy because compliance with the state policy would provide compliance with the federal policy.

Washington State does not have a qualitative habitat ranking system or associated habitat mitigation policy.

To comply with ODFW's Habitat Mitigation Policy, Oregon LNG held several meetings between 2007 and 2008 with ODFW, USFWS, and other stakeholders to discuss definitions of habitat types and categories. Habitat types and categories were initially described in Resource Report 3. For a summary of habitat type descriptions and categories associated with the Project, see Appendix A of this Plan.

6.1 Onsite Mitigation

6.1.1 Habitat Categories—Pipeline Corridor

Wildlife habitats found at the Pipeline include upland coniferous forest, upland deciduous forest (DF), riparian, palustrine scrub-shrub wetland, palustrine forested wetland, palustrine emergent (PEM) wetland, stream, agriculture/pasture/orchard/tree farm, and developed/buildings/roads.

Habitat by type, ODFW category, and watershed for the Project are summarized in Resource Report 3, Appendix 3F, *Wildlife Habitat Mapping of the Oregon LNG Terminal and Pipeline*, as updated in Appendix C to the Pipeline Supplement (Oregon LNG, 2014a).

Impacts habitat typing is not included for Washington because Washington does not have a corresponding state habitat mitigation policy. However, most of the effects in Cowlitz County would be to agricultural lands that would be restored following construction.

Table 6-1 displays the acres estimated to be affected by Pipeline construction activities by ODFW habitat category. Table 6-2 displays the acres estimated to be affected by Pipeline construction activities by habitat type in Oregon. Route selection avoided Category 1 habitats. In both the Coast Range and Lower Columbia provinces the highest quality habitat that would be affected are wetland types. Discrete patches of Category 2 conifer forest were also avoided by route selection. Most of the conifer forest in the Coast Range that would be affected is in younger age classes in second-growth forest. The greatest extent of habitat (80 percent) that would be affected by Pipeline construction is Categories 4 and 5, which are primarily private ownerships dominated by commercial forest and agricultural land use.

Riparian zone effects were avoided as much as possible through conscientious Pipeline routing and the judicious use of HDD methods. Where possible, important specimen trees, significant wildlife snags, and nest trees in riparian areas would be retained. Natural habitat features—such as logs greater than 12 inches in diameter, downed large wood, and rocks—would be retained. Effects on the riparian zone would be minimized by reducing the amount of clearing as much as possible, and by revegetating the cleared riparian areas as rapidly as possible following construction.

The entire width of the construction corridor, however, does not represent the permanent effect. For the purpose of analysis and disclosure, the 50-foot-wide permanent easement (Zones A, B, and C) is considered to be permanent because vegetation may be mowed (Zone A) or maintained at a height of 15 feet (Zones A and B), or cleared in the unlikely event of Pipeline repair (Zone C) (Figure 5-1). The remainder of the corridor where trees may grow to their full potential is considered to be a temporary effect (Zone D).

With the exception of the Compressor Station (less than 1 acre), none of the habitat effects along the Pipeline corridor represent a permanent loss of wildlife habitat in that the area is not being developed with impervious surfaces. However, there would be temporal effects on habitat cleared in Zone D and habitats in Zones A and B may be maintained in an early seral stage.

6.1.2 Threatened and Endangered Plants

Potentially suitable habitat was identified in Resource Report 3, Appendix 3G-3. Four plants listed by federal or state agencies as threatened or endangered or proposed for listing were identified as potentially occurring in the vicinity of the Project area. Of those species, three were determined to potentially occur within the Pipeline footprint based on evaluation of habitat requirements, elevation, and records of known occurrence.

The office review determined that habitat may be present along the Pipeline to support four rare plant species:

- Nelson's checker-mallow (*Sidalcea nelsoniana*)
- Water howellia (*Howellia aquatilis*)
- Bradshaw's lomatium (*Lomatium bradshawii*)

Of the four rare species evaluated, three have potential habitat within the Project area. One species, Golden Paintbrush (Castilleja levisecta), which is on the Federal Threatened and State Endangered lists, is considered extirpated in Oregon and southwestern Washington.

Because the proposed action would not likely have an adverse effect on any known individual rare plants or populations, and would not impact any designated critical habitat, no species-specific conservation measures are proposed. Oregon LNG would do preconstruction rare plant surveys in all areas where potential suitable habitat was identified in collaboration with the USFWS using USFWS habitat assessment and mitigation protocols in the year before Pipeline construction in order to encompass the complete range of bloom times for the identified species.

6.1.3 Revegetation

Clearing, grubbing, grading, and ground-disturbing activities resulting from construction of the Pipeline and Terminal facilities would necessitate reestablishment of vegetation. Onsite revegetation would serve to restore habitats and provide erosion control. Revegetation practices are addressed in the following document submittals supporting the preparation of the DEIS:

- Appendix 1I in Resource Report 1, *Typical Wetland and Waterbody Crossing Methods and Preliminary Site-specific Waterbody Crossing Plans*
- *Stormwater Pollution Prevention Plan for Construction of the Oregon LNG Terminal and Pipeline, Including Erosion Prevention and Sediment Control Plan; Spill Prevention, Control, and Countermeasures Plan; and Frac-Out Contingency Plan* (Appendix B to this Plan)
- Section 2.3.5 and Appendix 2P of Resource Report 2 (*Wetland Mitigation Plan*), as updated in the December 2014 supplemental filing (Oregon LNG, 2014b)
- Section 3 of the Applicant-Draft BA pertaining to fisheries
- Section(s) 3.5.1 and 3.5.3 of Resource Report 3, *Fish, Wildlife, and Vegetation*
- Section 7.3.3 of Resource Report 7, *Soils*
- Appendix 7G of Resource Report 7, FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan*
- Appendix 7H of Resource Report 7, the Natural Resources Conservation Service (NRCS) *Oregon & Washington Guide for Conservation Seedings and Planting*
- Appendix 7F of Resource Report 7, *Agricultural Impact Mitigation Plan*

6.1.3.1. Revegetation Along the Pipeline

After construction, the construction corridor would be revegetated and returned to the discretionary land use of the landowner, consistent with easement restrictions.

Onsite measures to restore vegetation would follow the standardized methods as defined in *FERC's Upland Erosion Control, Revegetation, and Maintenance Plan*. Refined methods would be necessary for ensuring successful reestablishment given the variation between the physiographic environments that the Project spans. For more localized specificity, the NRCS *Oregon & Washington Guide for Conservation Seedings and Plantings* (NRCS, 2000) would provide guidance for developing specific revegetation plans. Revegetation in forested habitats would consider guidance in Oregon State University's College of Forestry *Guide to Reforestation in Oregon* (Haase, 2000).

Oregon LNG would develop specific revegetation plans once the Project has been certified by FERC. Revegetation would occur in accordance with the following criteria:

- Site and soil capability or limitations
- Objectives of planting based on prevailing land use
- Elevation, precipitation, and seed zone
- Site-adapted species types and mixes
- Planting density or seeding rate and methods
- Amount, availability, quality, and sources of suited stock or seed
- Timing of planting or seeding
- Site-preparation and maintenance needs
- Known disease, insect, or other vegetative health issues
- Potential for success of planting and seeding application

Additional consideration would be given to the following criteria:

- Temporary over-winter cover and erosion control vs. final post-construction revegetation
- Agricultural land that may be put into immediate production
- Forest land that may be put back into immediate production
- Vegetative conditions and land use of the private landowners the easement crosses
- Lead time needed to produce and acquire available planting or seed stock in quantity
- Labor force required and the sequencing within the construction and operation schedule to conduct revegetation and maintenance
- Logistical complexities of transporting material onsite
- Potential opportunities for utilizing biomass resulting from clearing the Pipeline corridor onsite as mulch or organic amendments

After construction, the riparian habitat in the upland portions of the construction easements would be revegetated and returned to discretionary land use by the landowner, consistent with easement restrictions. Typically FERC recommends a 10-foot-wide mow strip centered over the Pipeline. In addition, FERC recommends that vegetation within 15 feet of the centerline may be maintained at a height of 15 feet. The remainder of the 75- to 100-foot-wide construction easements would revert to vegetation cover preferences or requirements of the landowner. For streams that currently contain riparian cover the following revegetation scenario would be adopted:

- Riparian vegetation (trees and shrubs) would be restored continuously for a distance of that matches the width of the current riparian buffer, except for a 10-foot-wide herbaceous strip immediately above the Pipeline itself. Where there is preconstruction continuous riparian cover greater than 25 feet perpendicular from the top of the bank, then the riparian restoration would extend out to match the riparian width of existing conditions up to the width from the top of the bank required by the Forest Practices Act.

6.1.3.2. Revegetation at the Terminal

Following construction activities at the Terminal site, pervious soil surfaces would be revegetated. Permanent erosion control seeding would be applied to finish grades for stabilization, and vegetation would be selected for compatibility with site conditions, complementarity with adjacent natural plant communities, and consistency with operations at the Terminal.

Upland areas would be covered with native nitrogen-fixing seed mixture taken from the list recommended by the NRCS for dredge spoil stabilization. Seeded surfaces would receive balanced fertilizer and mulch to promote germination. Water quality bio-infiltration facilities would be surfaced with a native herbaceous mix.

6.1.4 Invasive Vegetation

The technical memorandum titled *Oregon LNG Bidirectional Project—Invasive Vegetation*, located in Appendix 3Q of Resource Report 3 and submitted to FERC in June 2013 (Oregon LNG, 2013), identifies some of the noxious weeds and invasive plant species likely to occur within the Project area. Any invasive weeds encountered in the course of rare plants or wetland surveys would be documented. The Oregon Department of Agriculture (ODA) and 2013 Cowlitz County noxious weed list would be used.

Oregon LNG would take a multifaceted approach to control the spread of invasive species in the Project action area in order to ensure that the 50- foot permanent easement does not serve as a nursery for noxious weeds. It is assumed that landowners have a vested interest in controlling the spread of noxious weeds on agricultural properties.

Restoring the construction corridor by sowing native seeds would be the first step taken to reduce the likelihood that weeds would invade the corridor. Certified, weed-free seed would be specified in the construction contracts. In nonagricultural areas, trees and shrubs planted for restoration must also be native species. Mechanical methods such as mowing or grubbing can also be used to minimize the spread of noxious weeds, especially if mowing takes place before seed set. FERC procedures allow for a 10-foot-wide strip over the Pipeline to be maintained in a herbaceous state. Mowing or grubbing is the preferred method within riparian areas and wetlands.

Herbicides would be applied where it is necessary to control noxious weeds. Only USEPA-approved herbicides would be applied. Given the number of streams and wetlands in the Project area, only herbicides considered safe for aquatic areas would be used. A list of USEPA-approved herbicides that are also approved for use in and near aquatic habitats is attached to this technical memorandum. Each herbicide label includes specifics in terms of how many feet from any fresh or estuarine habitats, including wetlands, the product can be applied. Herbicide application would be conducted according to the methods outlined on the label and in accordance with federal and state regulations. FERC does not allow use of herbicides or pesticides within 100 feet of a wetland or waterbody except as allowed by the appropriate state or federal land management agency.

Additional measures would include the application of weed-free straw to exposed soils to prevent erosion. Construction equipment would be washed before it enters construction areas to avoid biological contamination from other sites.

6.2 Compensatory Mitigation

6.2.1 Unavoidable Impacts

The proposed strategy for compensating for long-term unavoidable and certain temporary impacts attributable to the Pipeline is the acquisition of land that would be managed as a conservation easement of in-kind, in-proximity Category 3 and 4 habitats. No Category 1 or 2 CF habitat would be impacted.

The 50-foot-wide stripe (Zones A, B, and C) is considered to be permanent impact area relative to the Pipeline. The remainder of the construction corridor constitutes a temporary loss of habitat.

Determination of the amount to be compensated is based on the following factors:

- A substantial proportion of the habitats that would be impacted are located on privately owned lands, of which commercial forestry and agriculture are the dominant land use.
- There is no Category 1 or 2 riparian habitat in the Lower Columbia or Coast Range provinces.
- Category 5 and 6 habitats would not receive compensatory mitigation.
- BP habitat Category 3 or 4 would not receive compensatory mitigation as these areas are under the jurisdictional maintenance of power line easements.
- Mitigation is not needed for HDD crossings.
- Riparian areas that require compensatory mitigation are determined as those streams with at least percent existing cover of woody vegetation immediately adjacent to a stream.
- Riparian habitat would be double counted and thus receive multiple mitigation treatments: onsite restoration; specific riparian restoration; and inclusion in counting impacts to upland habitat.
- Most of the forested riparian is typed as Category 3 or 4.
- Analysis concluded that stream temperatures would not be adversely impacted by clearing, so no compensatory mitigation is proposed beyond that specified in riparian mitigation.

Guidelines for compensatory mitigation are based on ratios created by Oregon LNG in cooperation with the agencies that administer state and federal terrestrial mitigation policies; ODFW and USFWS. Table 6-3 shows that Oregon LNG is generally proposing to provide compensatory mitigation for permanent impacts to habitat Category 3 and 4 CF and nonoak DF impacts at a 2:1 area ratio. CF and DF Category 3 and 4 habitat in temporary and ATWS would be provided at a 1:1 ratio.

A number of factors were considered in establishing habitat mitigation ratios:

- Pipeline habitat impacts are temporal in nature because the Pipeline would be buried: there would be no permanent impervious cover except for the Compressor Station; and wildlife would have unrestricted access to the same amount of area before and after construction.
- For purposes of permitting and mitigation, Oregon LNG would count the entire 50-foot width of the permanent easement as a permanent impact, even though trees and shrubs would be restored. FERC allows shrubs within 15 feet (30 feet total) of the Pipeline to be maintained at a height of 15 feet, thereby maintaining most of the easement in an early seral stage of development.
- Temporary and ATWS outside the permanent 50-foot Pipeline easement would be restored in-kind. Temporary and ATWS would be restored, consistent with the Oregon Forest Practices Act regarding reforestation.
- Mitigation for riparian areas would be provided in the following three ways: (1) riparian shrub areas would be restored in all but the 10-foot mow strip of the Pipeline corridor, which exceeds FERC standards; (2) compensatory mitigation for riparian impacts would be provided at a 1.5:1 ratio; and (3) calculations of upland impacts included riparian buffers and riparian areas would be included in land acquisitions associated with upland compensatory mitigation.
- Onsite restoration of the construction corridor is already an element of mitigation that would occur.
- Mitigation measures to benefit fish would also contribute to in-kind, in-proximity riparian compensation (i.e., instream enhancement, fish passage restoration).
- Coast Range compensatory mitigation would be managed and preserved for late-successional habitat

To offset these impacts, and to mitigate for the temporal loss of habitat from Pipeline clearing, Oregon LNG proposes to acquire land for securing conservation easements. This approach is also intended to offset unavoidable and temporal impacts related to upland and riparian resources in the Coast Range and would be intended to benefit a suite of compensatory objectives.

Acquisition of land for conservation purposes was identified in the Coast Range and has multiple beneficial

Attributes that would provide Category 2, 3, and 4 upland and riparian forested habitats, and potentially some Category 1 habitat are as follows:

- Existing special and unique habitats, suitable or occupied threatened and endangered habitat, older forest structure, aquatic and riparian habitats, and designated critical habitat;
- High-quality functional habitat can be managed for late-successional habitat and conserved in perpetuity
- Existing high-quality habitat
- provide sufficient replacement commensurate with mitigation ratios
- Larger contiguous parcels adjacent to existing conservation areas
- Capable of enhancing adjacent existing high-quality habitat
- Capable to provide opportunities for enhancing connectivity between existing high-quality habitats

Oregon LNG is exploring opportunities for acquiring land in the Coast Range. Land acquisition would be finalized once FERC issues NGA Section 7(c) authorization for the Project.

6.2.2 Rare Plants

Proposed compensatory mitigation for potential impacts to rare plant species and habitats are associated with the construction corridor of the Project. Compensatory measures proposed are additional to BMPs, plant salvage, and onsite restoration described previously.

Oregon LNG would do preconstruction rare plant surveys in all areas where potential suitable habitat was identified in collaboration with the USFWS using USFWS habitat assessment and mitigation protocols in the year before Pipeline construction in order to encompass the complete range of bloom times for the identified species.

If, during preconstruction surveys, rare plants are discovered, then additional compensatory mitigation would be provided at a ratio of 2:1 with a 1-acre minimum. The rationale for the 2:1 ratio is associated with the uncertainty that salvage and restoration would be successful.

6.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

6.3.1 Framework

The framework for operational mitigation originates from Resource Report 1—General Project Description, and Resource Report 3, Appendix 3B—*Biological Survey Reports – Aquatic Species and Habitat*. The framework is further supported by the wetland documents contained in Appendix E of this Plan, titled *Conceptual Wetland Restoration Monitoring Plan and Performance Standards* and *Review of Wetland Avoidance and Minimization Efforts*.

The purpose of the monitoring plan would be to confirm that performance standards are being properly followed and that performance standards are achieving the goals of habitat restoration and avoidance or minimization of adverse effects on the ecosystem. The scope of the monitoring plan scope would include the following:

- Monitoring would evaluate the effectiveness of onsite revegetation and the management and conditions of acquired conservation easements. Fee-in-lieu benefits would be reported based on accomplishment and progress updates from advocacy groups receiving the funding.
- Monitoring would occur at the Terminal and along the Pipeline alignment. Oregon LNG would conduct onsite restoration and ensure the reestablishment of vegetation in the Pipeline corridor. This includes restoring

disturbed areas with salvaged plant material, reseeding with native seed stock, or replanting with native plants. Site restoration would include a functional benefit of existing degraded plant communities through removal of non-native species.

- During operations, the 30-foot-wide strip within the 50-foot-wide permanent Pipeline easement may be maintained.
- The 10-foot-wide corridor may be replanted with herbaceous material. The 30-foot-wide area adjacent to the mow strip may be restored by replanting with shrubs.
- Trees would be planted just outside of the 30-foot-wide maintenance corridor Seasonal monitoring would be conducted by a qualified biologist for a period of 10 years following final installation using the standards set forth in the Performance Standards. Stratified random sampling would be employed to evaluate performance of upland habitat. Site reviews for upland habitats would be conducted in years 1, 2, 3, 5, 7, and 10 unless substandard performance warrants additional management in specific locations.

The monitoring report would contain the following information:

- Identification of sample locations
- Percent of planted materials surviving, classified by condition (e.g., vigorous, living, stressed)
- Percent cover for the following four classes: native forbs and grasses; non-native forbs and grasses; shrubs and trees; bare ground and rock
- Report on invasive vegetation, vandalism, dumping, wildlife damage or other conditions actually or potentially harmful to the restoration
- Identification of maintenance concerns (e.g., plants needing to be replaced)
- Representative color photographs keyed to recorded photo points

Invasion of noxious weeds is most likely to occur during the first 3 years after construction. Therefore, it would be important to inspect the Pipeline and Lateral easement in the Coast Range annually for the presence of noxious weeds during the first 3 years after construction or until native vegetation has become established. The best time to survey for invasive species is in the late spring or early summer (May to early July timeframe).

6.3.2 Performance Standards

Performance standards for the Pipeline corridor would be developed based on the specific revegetation plan. Monitoring would be conducted by a qualified biologist using best professional judgment. Performance standards would be established based on the following goals:

- Grass, shrub, and forest habitat diversity must be present to an extent equal to or better than preconstruction conditions.
- Diversity of species is equal to or better than the goals of the revegetation plan.
- Planting density is within 5 percent of planting plan—typically 60 to 80 percent survivorship (native species recruitment on the site may be included).
- Aerial cover is increased in successive years.
- Bare substrate represents no more than 20 percent cover after 3 years.
- No more than 10 percent cover of invasive species.
- If monitoring shows that performance standards are not achieved, Oregon LNG would recommend corrective management actions. Corrective actions may include invasive species control (typically spring/early summer); protective sleeves to minimize browsing damage by herbivores (typically applied spring/summer); and replanting (typically dormant or rainy season). Biologists would keep a written record to document the date of each visit, site conditions, and any corrective actions taken.

6.3.3 Contingencies and Adaptive Management

Quantification of habitat types and classifications was based on aerial photography conducted in 2007 for the portion of the Pipeline in Clatsop County and 2012 photography used for Columbia County. Since the earliest Pipeline construction would occur is 2015 and since logging activities are ongoing in the Coast Range, then habitat mapping would be out-of-date by the time construction begins. Oregon LNG would update habitat mapping before construction using photography that is no more than 2 years old at the time of construction.

The proposed mitigation plan established mitigation ratios for various types and classes of habitat impacts. If the results of updated habitat mapping differ from the original filed with FERC, then Oregon LNG would adjust the quantity and quality of terrestrial mitigation to be commensurate with impacts at the time of construction.

Surveys for rare plants were incomplete because some property owners denied access. Oregon LNG is committed to completing surveys for rare plants in areas with potentially suitable habitat with USFWS using USFWS habitat assessment and mitigation protocols. Oregon LNG would conduct these surveys in the year prior to Pipeline construction to encompass the complete range of bloom times for the identified species. Despite completion of recommended surveys, it is still possible that individuals or populations of rare plant species may be encountered in the course of Pipeline construction. In the event of such a discovery, a qualified botanist would be retained to verify identity of the plant(s) and make recommendations for addressing the situation

Oregon LNG would implement the following adaptive management procedures if Bradshaw's lomatium or other rare plants are observed within the Pipeline corridor during Project construction:

- Work near the rare plant(s) would cease immediately;
- A qualified botanist would verify identity and delineate the extent of the plant(s);
- The USFWS would be notified of the discovery; and
- All efforts would be made to avoid disturbance to discovered species, including implementation of micrositing to relocate the Pipeline where possible to avoid rare plant populations.

If disturbance to the plant cannot be avoided, Oregon LNG would minimize disturbance to the maximum extent practicable. Possible avoidance measures may include the following:

- Clearly delineate and fence rare plant populations;
- Retain a qualified botanist to provide monitoring during construction;
- Salvage plants; and
- Implement site restoration measures immediately upon completion of any work near rare plants.

SECTION 7

Wetlands

The purpose of the wetland mitigation plan is to present additional information on wetlands that are located within the construction and permanent easements (also referred to as TWS and permanent easement) for the Oregon LNG Pipeline, Terminal, and related aboveground facilities. For wetland features in the Project area, avoidance and minimization efforts have been evaluated in the context of both area and wetland function. The approach to mitigation follows the USACE, DSL, Ecology, and USEPA rules and guidance with the goal of no net loss of wetland functions and values. The approach follows the USACE, DSL, and Ecology mitigation sequencing and, where compensation is required, uses a watershed approach to select available resource replacement sites that offer the greatest functional benefits.

The following definitions from OAR 141-085 0510 provided the framework for developing onsite mitigation measures:

- “Temporary Impacts” are adverse impacts to waters of the state that are rectified within 24 months from the date the impact occurred.
- “Temporal Loss” means the loss of the functions and values of waters of this state that occurs between the time of the impact and the time of their replacement through compensatory mitigation.

7.1 Onsite Mitigation

Most of the wetlands in the study area would be avoided by the Project, with temporary and permanent impacts for the Terminal and Pipeline totaling approximately 174 acres of wetlands identified in the Project study area.

7.1.1 Pipeline

7.1.1.1. Avoidance and Minimization

A variety of methods have been implemented during Project design to avoid and minimize impacts to wetlands. Examples of methods are as follows:

- Revise layout
- Alter the Pipeline route
- Co-align with existing easements and rights-of-way
- Cross wetlands at the narrowest point possible
- Select appropriate construction techniques
- Use HDD to avoid wetlands

Avoidance

Oregon LNG avoided wetlands to the greatest extent possible while still providing a Project route that is constructible yet with minimal impact and is acceptable to the public and regulatory agencies.

Site visits were conducted with state and federal agency staff to view stream crossings identified as areas of concern during preliminary agency reviews. Micrositing adjustments were made to avoid or minimize impacts to wetlands or streams. For example, in a location where the Pipeline was proposed to cross a beaver marsh on the Clatskanie River, the route was relocated to avoid the wetland and limit impacts to a narrow stream crossing.

During several design iterations, the Pipeline alignment and TWS were shifted away from wetlands and other waters, where possible reducing the acreage of impact. In addition, during construction, wetlands outside of the construction corridor would be demarcated in the field and identified on work plans as “no work zones” to avoid additional wetland impacts.

Palustrine forest (PFO) wetlands and wetlands greater than 5.0 acres were evaluated on an individual basis and for purposes of analysis considered to be of high value. Further efforts to avoid or minimize permanent impacts to high-value wetlands consist of sorting the wetlands by their size, Cowardin class and reevaluating the potential for further avoidance or minimization. Of the 489 wetlands identified within the Terminal and Pipeline study area, 87 high-value wetlands were identified. With the use of avoidance measures such as route shifts and HDD, Oregon LNG has avoided permanent impacts to 31 high-value wetlands and minimized impacts to 28 others. Table 7-1 identifies high-value wetlands and the specific measures taken to further avoid and minimize permanent and temporary impacts.

Large wetland areas would be avoided using the HDD construction method. More than 24 acres of high-value wetlands associated with the Adairs Slough the Lewis and Clark River area would be avoided using the HDD drilling method.

The Pipeline was also aligned so that high-value streams could be crossed at a right angle or crossed using HDD techniques and avoided completely. Approximately 1.65 miles (27.5 percent) of the area from MP 0 to MP 6 would be constructed using the HDD construction method. Most of this area is behind dikes where there is potential for floodplain restoration, reconnecting historic floodplain to the tidal estuary. In the HDD areas, the Pipeline would be deep and would not preclude surface restoration. For the remaining 4.35 miles, Oregon LNG is anticipating shallow groundwater. Before final design, Oregon LNG would consider where weight-coating is required between MP 0 and MP 6 to make the Pipeline compatible with high water tables or future restoration efforts. Oregon LNG would coordinate with ODFW and other stakeholders to determine whether there are areas with a low water table (that is, areas not otherwise requiring weight-coating) and which are priority sites for restoration. At this stage in planning, Oregon LNG would consider what reasonable measures could be taken to accommodate future wetland restoration in those drier areas identified as priorities for restoration and where weight-coating would not otherwise be needed.

ATWS are associated with HDDs and perennial stream crossings. Most would be located 150 feet away from the top of bank of streams which exceeds FERC's minimum standard by 100 feet. ATWS are sited less than 150 feet where the existing zone of forested riparian cover is less than 150 feet or where the risks of erosion are low. ATWS in riparian areas could have an indirect effect on streams or wetlands by increasing the risk of erosion near the wetland or waterbody as a result of land clearing. Extending the distance between ATWS and a wetland or waterbody reduces the risks of sediments eroding into the wetland or waterbody. Additionally, BMPs and erosion control applications outlined in the *Conceptual Wetland Restoration Monitoring Plan and Performance Standards* (Appendix E) would contribute to reducing risks as well.

Further avoidance efforts are demonstrated with the type of access road the Project proposes to use. Access to the temporary and permanent Pipeline easement and aboveground facilities would be through existing public and private roads to the extent practical. Where the Pipeline parallels existing utilities, Oregon LNG would use the utility maintenance access roads to the extent practical. Oregon LNG would also use a combination of existing paved, existing gravel, modified gravel, pasture roads, and other conveyances as appropriate.

In general, access roads would lead to the Pipelines approximately every mile along the routes of the Oregon Pipeline. Of the access roads to be used for the Project, few existing road need improvements, primarily little more than additional gravel. None of the new access roads are proposed in areas that would cross wetlands or waterbodies. Existing drainage patterns and culverts would be maintained during construction. Erosion and sedimentation controls would be installed at the limits of the access roads where necessary.

Oregon LNG would not construct any new permanent bridges or culverts along the Pipeline routes at stream crossings. During land clearing and construction streams up to about 30 feet wide would be crossed using temporary bridges. Equipment would be driven around wider crossings. For post-construction maintenance, heavy equipment would not be driven across streambeds. Equipment such as a brush-hog, which may be required for controlling vegetation, would access the Pipelines via the predetermined existing access roads stationed approximately every mile along each route. Should access by a brush-hog type of machine be impractical, clearing as required would be accomplished manually with hand tools.

Minimization

The steps involved in modifying the Pipeline alignment in order to minimize wetland impacts included the following:

- HDD methods would be used to install the Pipeline many feet below the surface of wetlands and streams.
- The Pipeline was aligned parallel or with existing road right-of-way (ROW) utility corridors, or previously disturbed areas.
- The Pipeline route was aligned so that wetlands would be crossed at their narrowest point when possible.
- The Pipeline was aligned so that streams would be crossed at a right angle to their banks in order to minimize negative impacts to riparian areas and streambed.
- The width of the Pipeline ROW would be reduced to 75 feet when crossing nonagricultural wetlands to minimize the area of disturbance.
- TWS would be located in areas outside of wetlands to minimize the number of acres of disturbance.

Pipeline Routing

In selecting the proposed route, Oregon LNG sought to minimize impacts to the environment and landowners by seeking to parallel other linear features to the greatest extent possible or practical.

Minimizing impacts to wetlands did have limitations due to rugged topography, high densities of wetland areas, and a preference to avoid high-quality wetland areas and streams. In areas where a high density of wetlands existed, the Pipeline was aligned in a way that minimized impacts to most wetlands. The Pipeline route was sometimes aligned to cross wetlands with low functional assessment values in order to avoid wetlands with higher values. If the Pipeline could be microsited to avoid every wetland, this would increase the overall length of the Pipeline and period of active construction which could result in more permanent impacts to the landscape and longer periods of temporary disturbance and active construction along the Pipeline route.

Some of the wetlands crossed by the Pipeline route are agricultural wetlands. These wetland areas may have wetland hydrology at least seasonally or have altered wetland hydrology (e.g., as a result of drain tiling or irrigation ditches), but do not have wetland or native vegetation due to farming activities where native vegetation is replaced by crops, and therefore provide low quality or only seasonal natural habitat for most species.

Approximately 10.86 miles of wetlands are crossed by the Pipeline route and approximately 2.47 miles are agricultural wetlands. No long-term impacts to these wetlands are anticipated because, following construction, these areas would be restored to their preconstruction topographical and hydrological patterns, and would be allowed to return to their preexisting agricultural practices. This process would result in no net loss of wetland acreage within the Pipeline corridor. Oregon LNG would follow the construction procedures and mitigation measures in the FERC Procedures requiring standard upland protective measures, including workspace and topsoiling requirements, as they apply to these agricultural wetlands. The width of the ROW would not be reduced to 75 feet in agricultural wetlands.

Construction

Efforts would be made before, during, and after Pipeline construction to minimize the extent and duration of Project-related disturbances to wetland resources. For example, Oregon LNG would segregate and salvage the top 1 foot of topsoil from nonsaturated wetland areas to be disturbed by trenching (generally coincident with the 10-foot mow strip maintained during operation) and replace the topsoil at the finish grade after trench reconstruction. The duration of temporary wetland disturbance during Pipeline construction would be minimized. The backfilled trench would contain anti-seep plugs at appropriate intervals to prevent a French drain effect.

Oregon LNG would make every effort to maintain a reduced construction easement width of 75 feet in wetlands, in accordance with the FERC Procedures. Agricultural wetlands are not included in this width restriction. During construction, vegetation would be manually cleared throughout the entire 75-foot construction easement. There would be no grubbing, and the root systems would be left intact except for an approximately 10-foot-wide area directly over the pipe trench. This swath would be grubbed in preparation for trenching and pipe placement.

Work within the 75-foot construction easement would be conducted on mats where wetland soils are wet at time of construction to minimize impacts to vegetation and to minimize soil compaction. When constructing the Pipeline through the wetlands, the only soil excavation would occur at the Pipeline trench area, which would be about 10 feet wide, depending on the depth of the pipe. Temporary fill would occur next to the trench, where soil and plant materials from the trench would be stockpiled. Indirect soil disturbance, resulting in removal/fill, is expected to occur throughout the 75-foot-wide construction corridor from aboveground vegetation removal and mechanized land clearing, which could result in soil displacement. Following construction, all wetlands would be rehabilitated to preconstruction soil and hydrology conditions, and revegetated.

Four construction procedures would be typically used to minimize impacts associated with construction of the Pipeline on water resources, as described below.

Crossing Method 1

This method would be used in dry wetlands where soils are stable enough to support equipment without sinking (for example, mineral hydric soils), or in wetlands that have already been disturbed to provide sufficient traffic ability. A reduced construction easement of 75 feet would be maintained and overland construction techniques would be used, unless exceptions are required by site conditions. Topsoil disturbed by trenching would be segregated, and no matting would be used if conditions are dry.

Crossing Method 2

This method would be used in wetlands where the soils are too wet (for example, permanently or semipermanently saturated or histic epipedon is present) to support Pipeline construction equipment. Timber mats would be used as necessary to support the construction equipment. A reduced construction easement of 75 feet would be maintained and overland construction techniques would be used, unless a variance has been granted. Topsoil disturbed by trenching would not be segregated.

Crossing Method 3

This method is not anticipated for use during the Project. It is used in wetlands with standing water (permanent or semipermanently flooded) where it is necessary to use push/pull construction techniques. A construction corridor wide enough for only a single tractor to work on timber mats is used. The trench is dug and the pipe pulled into place. There are no passing or working lanes, only room for spoil on each side of the trench with the digging/pulling tractor in the middle. A reduced construction easement of 75 feet is maintained and overland construction techniques are used, unless a variance has been granted.

Crossing Method 4

HDD methods would be used for specialized crossings of large wetland areas. In general, directional drilling results in fewer adverse impacts and less turbidity than conventional excavation methods. Directional drilling is limited in application and dependent on critical wetland characteristics, including subsurface lithology, crossing length, burial depth, sediment composition, bank conditions, and access. Adverse environmental impacts that may result from drilling operations on waterway crossings would be related to discharge and transportation of drilling fluid; however, aside from turbidity effects, drilling fluid is a relatively environmentally benign substance. Mitigation of any adverse impact from drilling fluid would be by collection and cleanup of spilled material.

Buffers would be clearly marked in the field during construction activities. Operation of construction equipment in wetlands would be limited to that needed to clear the easement, dig the trench, fabricate the pipe, install the pipe, backfill the trench, and restore the easement. A detailed description of other measures to minimize construction and post-construction maintenance effects on wetlands is provided in Section VI of the FERC Procedures.

The FERC Procedures require ATWS to be located at least 50 feet outside identified wetland boundaries, except where the adjacent uplands consist of actively cultivated or rotated cropland or other disturbed land.

During discussions with USFWS and NMFS for this Project, it was agreed that (unless approved by USFWS, NMFS, and ODFW) ATWS would be set back 150 feet from wetlands and streams. Oregon LNG has made extensive efforts to locate the ATWS at least 50 feet from wetlands and other waterbodies. In addition, overnight parking of vehicles, storage of fuels and other hazardous materials, and refueling activities would take place no closer than 150 feet from a wetland or a stream, unless full containment of potential contaminants is provided. Under certain clearly defined conditions, and subject to agency approval, ATWS may be placed closer to wetlands or waterbodies where the ATWS placement would not increase impacts to streams or fish habitat. BMPs and erosion control applications outlined in the Wetland Restoration Plan would be implemented to reduce risk of sediments entering the waterbodies.

7.1.1.2. Best Management Practices and Wetland Rehabilitation

The construction schedule would consider the recommended ODFW in-water work periods unless an extension of those work periods is granted. The start and end dates are variable depending on the region and the stream; start dates can begin as early as June 1 and end dates are as late as October 15.

The construction schedule would also consider biological patterns to minimize potential impacts to species and habitats. In accordance with the FERC Procedures, restoration and monitoring of wetland crossings would be conducted to help ensure successful wetland revegetation. Oregon LNG would abide by additional wetland construction methods, monitoring, and restoration as required by the FERC Procedures.

The rehabilitation/restoration plan is proposed for temporary wetland impact acreage. Rehabilitation of the Pipeline construction corridors to preconstruction wetland conditions would include the following activities:

- Work in the Lower Columbia River Estuary would be timed to take advantage of seasonal low and high tides.
- A cover crop (in nonagricultural areas) would be planted and erosion control implemented before the rainy season following land clearing.
- Riparian areas would be cleared the same year in which the Pipelines are constructed. Riparian areas would be kept intact when land is cleared a year in advance of construction.
- Work timing would be coordinated with the biological needs of special-status species. For example, no harvesting of trees would occur until migratory bird species have completed nesting activities, after August 15 and before March 15, unless biological surveys indicate the absence of nesting.
- Where the Pipeline trench may drain a wetland (steep slopes), clay plugs would be constructed or the trench bottom would be sealed as necessary to maintain the original wetland hydrology.
- Oregon LNG would segregate the topsoil up to 1 foot deep over the area disturbed by trenching in wetlands where hydrologic conditions permit this practice, and this topsoil would be placed in the trench at the end of backfilling of trench spoils once the trench is backfilled.

For the trench excavation area, natural revegetation with native species would be encouraged by providing suitable soil conditions and applying salvaged topsoil from cleared trench area, except that weed-infested topsoil would not be reapplied. Proper topsoil stockpile procedures (aeration, moisture, shading) would ensure that viable plant propagation sources (e.g., viable seeds, rhizomes, roots, spores, fungi) are replaced following construction in the trench area. Temporary erosion control seeding with sterile wheat grass or other accepted seed mixes would be used to stabilize soil until natural revegetation occurs. Revegetation efforts would include the following measures:

- Vegetation clearing would take advantage of the dry season.
- Revegetation would focus on the cool, rainy season.
- Permanent erosion control would consist of seeding with native wetland species, and seedbed preparation where soils are displaced or compacted by equipment.

The wetland areas temporarily impacted by vegetation clearing, equipment traffic, and material storage outside the trench area would be rehabilitated by reestablishing wetland vegetation from seedbank germination and vegetative propagation via resprouting of live roots and propagules left intact and protected during construction. Sterile wheat grass cover would be used to temporarily stabilize soil until natural germination occurs. In some instances, a permanent native wetland seed mix would be applied to ensure adequate cover of the site by desirable species. The seeding and planting mixtures recommended by NRCS for Oregon would be used as a basis for developing a Project-specific seed mixture. Measures would be taken to control the spread of noxious weeds.

For natural regeneration of temporarily cleared forested wetlands outside the 10-foot-wide maintenance corridor, the following actions would be taken:

- To reduce injury to viable roots and shoots, construction traffic would be managed to reduce areas affected by soil compaction and rutting; supported by mats, pallets, or other ground pressure dissipaters in moist or wet soils; and characterized by low ground pressure equipment where terrain allows.
- Woody debris, chipped woody vegetation, and unmerchantable logs greater than 12 inches would be salvaged for surface application outside the 10-foot-wide maintenance corridor where existing downed wood is insufficient.
- Various site specific seed mixes would be used for temporary erosion control seeding to avoid conflicts with the permanent cover.
- Where compatible with preconstruction woody species, seeds of native woody wetland species would be incorporated into permanent erosion control seed mixes.
- If annual monitoring during 3 years after construction indicates that disturbed wetland areas are not successfully revegetating with desirable woody plants, supplemental planting would be undertaken.

Restoration and cleanup would begin after the trench is backfilled. The disturbed areas would be graded as closely as practical to preconstruction contours. During cleanup, trash that remains in the easement would be removed and disposed of in approved areas in accordance with applicable regulations. Organic refuse unsuitable for spreading over the easement would be disposed of at an authorized facility. Disturbed areas would be restored as closely as practical to their original condition, permanent erosion control measures would be installed as appropriate, and revegetation measures would be implemented. In addition, line markers would be installed directly above the buried Pipelines in accordance with 49 CFR 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards, Subpart M, “Maintenance,” 192.707.

7.1.2 Terminal

The Terminal’s location was selected to minimize the Project’s environmental impacts, including high-value wetlands, air emissions, water usage, and potential fisheries resources impacts, by siting the Terminal on land that is appropriately zoned for industrial use, is on an existing deep-water channel, and is relatively close to major natural gas pipeline networks and markets.

The initial conceptual design for the Terminal was a layout in a square that would have extended the area of fill into the low marsh, mudflats, and shallow subtidal areas on the east side of the northern end of the East Bank Skipanon Peninsula (ESP). Subsequent layouts were designed along a north-south axis to avoid these high-value habitats. Estuarine wetlands are considered high-quality wetlands because of their importance to salmonids. There is greater nutrient contribution to the estuary from high and low marshes than from interior palustrine wetlands. Modifications to the site layout were made in the 2012 to accommodate the change in the project description from primarily import to primarily export of natural gas.

Principles used in siting the Terminal facilities included the following:

- Avoiding impacts to low marsh and shallow subtidal habitats that have high functional value for salmon
- Maximizing the use of nonwetland area
- Avoiding estuarine wetlands would be more important than avoiding freshwater wetlands

- Maximize use of existing roads (Northeast King Avenue) to access the Terminal site
- Demarcating wetlands outside of the construction corridor in the field and identified on work plans as “no work zones” to avoid additional wetland impacts

The main goal in development of the proposed layout was to minimize wetland impacts to the higher quality wetland. The proposed layout was also developed to balance the excavation volume with the fill volume such that imported fill material would be minimized. Estuarine wetlands are higher quality in terms of providing functions for salmonids because of surface water connectivity. There is greater nutrient contribution from estuarine wetlands than from interior palustrine wetlands. The proposed layout has less impact to the estuarine wetland type than the palustrine wetland type.

The proposed layout for the Project has been compressed as much as possible to avoid and minimize wetland impact, while at the same time remaining consistent with the Export Project Purpose and Need for providing bidirectional capability.

7.2 Compensatory Mitigation

Oregon LNG intends to avoid, minimize, and, where necessary, compensate for disturbance to wetlands associated with the construction and operation of the Project. For all long-term temporary construction impacts, mitigation would occur onsite through restoration of the areas to PEM, PSS, or PFO. For permanent Cowardin class changes that would occur to palustrine forest in the 30-foot-wide permanent easement (Areas A and B on Figure 7-1) and to PSS in the 10-foot mow strip (Area A on Figure 7-1) and permanent Terminal impacts, Oregon LNG intends to provide offsite compensatory mitigation.

Approximately 391 acres of wetlands were identified in the entire Project area. The Project estimates approximately 150 acres of temporary and permanent wetland impacts. Permanent unavoidable impacts consist of approximately 57 acres of wetlands, inclusive of the Terminal and associated supporting infrastructure.

Avoidance of some wetlands was not feasible because of the following Project constraints:

- Large wetland complexes spanning several acres not entirely avoidable
- HDD method not feasible for small wetlands due to greater overall environmental impacts
- Orientation of sensitive stream crossings prevented complete avoidance of adjacent wetlands
- Preference to use existing utility and road ROW resulted in greater impacts to wetlands

7.2.1 Pipeline

Construction of the Pipeline would include ground-disturbing activities for installation of the Pipeline itself, associated aboveground facilities, and construction staging/storage areas. Construction of the Pipeline would result in short-term disturbances to wetland hydrology, water quality, and, where new permanent easement is required, long-term disturbance in the form of functional conversion of forested wetlands to emergent wetlands within the 10-foot maintenance corridor. Impacts to wetlands associated with the Pipeline construction and operation were quantified based on the proposed activity in temporary construction and permanent operation zones.

Of the approximate 276 acres of wetlands identified within the Pipeline study area, approximately 23 acres of permanent and 85 acres of temporary impacts would result from activities associated with construction and operation of the Pipeline.

7.2.1.1. Permanent Impacts

During operations, a 30-foot-wide area within the 50-foot-wide permanent easement would be routinely maintained at a maximum frequency of once every 3 years. This area would be maintained free of trees over 15 feet tall. Within the 30-foot-wide maintained area and centered over the Pipeline would be a 10-foot-wide mow strip. The 10-foot-wide mow strip would be maintained annually in a nonwoody or treed condition to allow line-of-sight for aerial surveys. Figure 7-1 and Table 7-2 show the 75-foot construction and 50-foot permanent easements and the construction and maintenance activities that would occur in each. This table also shows the type of impacts to wetlands and the type of wetland class conversion that would occur.

The acreage extent of permanent impacts to wetlands and the compensatory offset is displayed in Table ES-2. Mitigation ratios are based on ODFW Habitat Categories.

7.2.1.2. Temporary Impacts

The alignment of the main Pipeline would temporarily impact approximately 85 acres of jurisdictional wetlands. When constructing the Pipeline through the wetlands, the only soil excavation would occur at the Pipeline trench area, which would be about 10 feet wide, depending on depth of pipe. Temporary fill would occur next to the trench where soil and plant materials from the trench would be stockpiled.

During construction, vegetation would be cleared manually throughout the entire 75-foot construction easement and use of heavy equipment would be minimized. There would be no grubbing and the root systems would be left intact except for the 10-foot-wide area directly over the pipe trench. This swath would be grubbed in preparation for trenching and pipe placement. Work within the 75-foot construction right-of way would be conducted on mats to minimize soil compaction and minimize impacts to vegetation. Following construction, wetlands would be rehabilitated to preconstruction soil and hydrology conditions, and revegetated.

As a result, the following assessment of Project construction impacts can be made for the 75-foot-wide construction corridor:

- Impacts to wetlands would be short-term and temporary throughout the construction easement (e.g., reestablishment of vegetation beginning within days or weeks of cessation of site work), with the exception of the trench excavation area.
- In the estimated 10-foot-wide trench area, impacts would be longer-term and temporary and herbaceous wetlands would recover more slowly as a result of clearing, grubbing, and soil excavation.

7.2.2 Terminal

The land-based portion of the Terminal includes the Terminal footprint, Terminal access road, and new water supply and wastewater disposal pipelines to connect to City of Warrenton water and wastewater systems. Construction of the Terminal and pier, would affect estuarine and nontidal wetlands in the area, resulting in both temporary and permanent impacts to wetlands. Siting of the proposed Terminal has gone through several iterations in an effort to avoid impacts to high-quality wetlands.

Total wetland impacts from construction of the Terminal and associated facilities would be approximately 38.07 acres, with 34.92 acres of permanent impacts and 3.15 acres of temporary impacts.

7.2.2.1. Permanent Impacts

Impacts to wetlands associated with the Terminal and related facilities were considered permanent if they were in the permanent facility or removal/fill footprint. For permanent Terminal impacts, Oregon LNG intends to propose offsite compensatory mitigation.

7.2.2.2. Temporary Impacts

Impacts to wetlands associated with the Terminal and related facilities were considered temporary if they were within the area disturbed by construction but outside the permanent facility and removal/fill footprint. In accordance with state and federal regulatory requirements, Oregon LNG would offset temporary loss of wetland function and values by restoring functions to the impacted area upon completion. Compensation for temporary impacts to wetlands as a result of Terminal construction will be mitigated through onsite wetland rehabilitation. To the extent feasible, rehabilitation of the Pipeline construction corridors to preconstruction wetland conditions will be undertaken. This will involve topsoil segregation and replacement, topsoil management to maintain viability of seedbank and vegetative propagules, reconstruction of grades, permanent erosion control seeding with native wetland species, and seedbed preparation where soils are displaced or compacted by equipment.

7.2.3 Mitigation Banking and In-lieu or Fee-in-lieu Payment Strategy

Compensation for wetland impacts at the Terminal will include both In-Lieu Fee bank credits and offsite, in- kind mitigation. DSL currently has mitigation credits in the Lower Columbia In-Lieu Fee bank. The Project proposes utilizing 1.9 credits for Terminal impacts. The remaining 33.02 acres of impacts from the Terminal will be compensated through an in-kind, offsite Youngs River mitigation site described in Section 7.2.4 below and in Section 5.2.2.2 above.

For the Lower Columbia–Clatskanie River basin in Washington, wetland mitigation would consist of purchase of credits in the Columbia River Wetland Mitigation Bank or another mitigation bank that may be in service prior to construction.

7.2.4 Land Acquisition and Conservation Easement Strategy

7.2.4.1. Lower Columbia River Basin

For impacts associated with the Terminal construction and operation, including pile-driving noise effects, ballast and cooling water withdrawals, dredging and dredge material disposal, Oregon LNG would enhance approximately 140 acres of diked pasture land at the mouth of the Youngs River where historical tidal floodplain would be reconnected to the estuary (see Figure 7-2). The riverside parcel is currently used for grazing and protected from flooding by a levee. Oregon LNG intends to breach the levee to create estuarine wetland habitat and provide access for federally listed salmonids and other aquatic species. Salmonid and other fish habitat at this strategic site at the mouth of the Youngs River would be enhanced by restoring meandering historic channels within the property. To ensure that juvenile salmonids can utilize newly created marsh habitat during low tide conditions, Oregon LNG would create three breaches in areas that facilitate connection to existing subtidal habitat in Youngs River. The site would be reconnected to tidal exchange (historical condition) and develop its own natural equilibrium based upon the actual tidal, riverine, and sediment processes following construction. The proximity of subtidal habitat is one of the factors that determine whether juvenile salmonids would utilize marsh habitat because they require nearby refuge during low tide conditions. After native freshwater marsh plants have recolonized the property, the marsh is expected to provide productive new rearing habitat for juvenile salmon that use Youngs Bay, and possibly for prey items for green sturgeon.

A legal instrument is in place for Oregon LNG to use the Youngs Riverproperty site for mitigation, including an agreement for a long-term conservation easement as a condition of a deed. There are provisions for supporting long-term maintenance and management including a revolving or endowment fund. Oregon LNG would prepare a long-term management plan that would be implemented by a third-party conservator.

Mitigation goals include the following:

- Breaching an existing levee reconnecting 140 acres of historical floodplain along the Youngs River
- Restorating anadromous fish rearing, migration, and refugia habitat in the lower Youngs Bay watershed
- Creating a low-maintenance and self-sustaining system
- Maintaining the safety of landowners behind the dike
- Creating estuarine wetland habitat for federally listed salmonids and other aquatic and terrestrial species

Mitigation objectives include the following:

- Restoring high and low tidal marsh wetland
- Enhancing wetland hydrology by sizing breaches to accommodate natural hydroperiod, tidal regime and peak flows
- Adding habitat structure by providing woody debris
- Reestablishment of self-sustaining native plant communities

- Providing access to preferred rearing and refuge habitat
- Providing aquatic species support by export of organic matter
- Increasing the quantity and quality of off-channel juvenile salmonid habitat for Youngs River salmonid populations by restoring more than 2.5 miles of off-channels habitat

7.2.4.2. Nehalem and Lower Willamette River Basin

To offset unavoidable permanent impacts to approximately 11.26 acres of Habitat Category 2 and 3 associated with the Pipeline segments in the Nehalem and Lower Willamette River basin, Oregon LNG is working with a private landowner to restore and enhance 45 acres of floodplain adjacent to the Nehalem River (see Figure 7-3). The property contains a large remnant river oxbow with an outlet to the Nehalem River. Much of the property consists of a monoculture of reed canary grass used for grazing cattle. A ratio of 3:1 for enhancement and 1:5:1 of wetland creation is proposed. Mitigation objectives for the site include the following:

- **Salmon restoration and enhancement**. Salmon fry access the site via the remnant oxbow tributary during annual freshets and become trapped within the reed canary grass. Mitigation objectives include the establishment of slow-water salmonid refugia that contains high quality habitat. Site modifications would restore necessary contours and reestablish native vegetation.
- **Floodplain enhancement and forest restoration**. The floodplain is mowed and grazed annually. Mitigation would create additional wetlands within the floodplain. The wetlands would retain floodwater and slow the velocity of the water flowing back into the river as floodwaters recede. Floodplain forest would be restored by replanting native species. This site has been identified as the western extent of Oregon ash plant assemblage. The site currently has small remnant patches of ash. Mitigation goals are to expand and restore the floodplain forest and scrub-shrub communities.

7.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

Oregon LNG was unable to delineate wetlands on properties where access was denied during the planning and permitting phase of the Project. Once Oregon LNG gains right-of-entry, then wetland delineations would be completed. Federal and state permit applications took a conservative approach in determining the amount of permanent impacts to wetlands by counting National Wetland Inventory wetlands and areas with hydric soils as jurisdictional wetlands for the purposes of determining the mitigation requirements.

Oregon LNG would recalculate the area of jurisdictional wetlands that would be impacted and recalculate the amount of wetland mitigation that is necessary upon completion of the final field delineated surveys. In the unlikely event that additional mitigation is needed, Oregon LNG would provide it, consistent with the conceptual plan (e.g., purchasing credits in approved mitigation banks). However, compensatory mitigation sites are oversized to accommodate additional unanticipated impacts to wetlands.

If route changes occur during construction, then biologists would be deployed immediately to determine if wetlands are present in the area of the route change. If present, then wetlands would be delineated and reported to DSL and USACE within 48 hours of discovery. Impacts would be evaluated to determine if additional mitigation would be necessary.

7.3.1 Framework

The framework for operational mitigation is documented in the technical memorandums in Appendix E titled *Conceptual Wetland Restoration Monitoring Plan and Performance Standards* and *Review of Wetland Avoidance and Minimization Efforts*.

Seasonal monitoring of wetland restoration along the Pipeline would be conducted by a qualified wetland scientist for a period of ten years following final installation using the standards set forth in the Performance Standards.

The monitoring report would consist of the following:

- Vegetation transect (or transects depending on size of wetlands) that detail herb, shrub, and tree aerial cover at radii of 3 feet, 15 feet, and 30 feet, respectively
- Percent of planted materials surviving, classified by condition (e.g., vigorous, living, stressed)
- Percent cover for the following four classes: native forbs and grasses; non-native forbs and grasses; shrubs and trees; bare ground and rock
- Documentation of invasive vegetation, vandalism, dumping, wildlife damage, or other conditions actually or potentially harmful to restoration
- Maintenance concerns (e.g., plants need to be replaced)
- Color photographs that show the restoration site, taken from a fixed photo point (or points depending on size of wetland) drawn on a map of the restoration area, keyed to lines of sight from those photo points
- Monitoring reports submitted to the permitting agencies (DSL and USACE)

Table 7-3 summarizes the restoration monitoring schedule.

7.3.2 Performance Standards

The proposed performance standards would be evaluated by a qualified biologist using best professional judgment. Table 7-4 summarizes the performance standards that would be used to evaluate success of the planting according to established landscape standards for wetland vegetation communities in the appropriate zones (Franklin and Dyrness, 1973) west of the Cascade Crest.

If any monitoring report shows that performance standards are not achieved, Oregon LNG would recommend corrective management actions. Wetlands with substandard performance would be monitored annually until there are two successive years demonstrating successful performance. Corrective actions may include invasive species control (typically spring/early summer); protective sleeves to minimize browsing damage by herbivores (typically applied spring/summer); and replanting (typically dormant or rainy season). Biologists would keep a written record to document the date of each visit, site conditions, and any corrective actions taken.

SECTION 8
Stream Channels and Waterbodies

Mitigation measures for stream channels and waterbodies are derived from Section 3.6 and Appendix D of the Applicant-Draft BA, Appendix 2B in Resource Report 2, and Section 3.5.1 in Resource Report 3. Anticipated construction-related impacts and specific conservation methods including avoidance, minimization, and mitigation efforts are addressed in Resource Report 2; in the SWPPP (Appendix B in this Plan); in the *Wetland Mitigation Plan* (Appendix 2P of Resource Report 2, as revised in the supplemental filing [Oregon LNG, 2014b]); and in Resource Reports 1 and 7.

Because the Pipeline crossings of stream channels and waterbodies would occur in waters owned by the state of Oregon, actions are under the jurisdiction of DSL OARs "Governing the Issuance and Enforcement of Removal-Fill Authorizations within Waters of Oregon Including Wetlands" (OAR 141-085). Crossings of stream channels and waterbodies also occur in the state of Washington. The Revised Code of Washington (RCW) and Washington Administrative Code (WAC) are the bodies of law governing the state's associated water quality regulations. The USACE provides Ecology with the jurisdictional authority to regulate the filling and removal of material in the waters of the state, including wetlands, under the applicable WAC 173-201A. The WDFW administers hydraulic code for the protection of freshwater habitat.

In general, avoidance, minimization, and mitigation of impacts to waterbodies during Pipeline construction would follow the FERC Procedures. Pipeline stream crossings would also require ODFW fish passage approval per Oregon Revised Statute 509.580-910, and WDFW Hydraulic Project Approval per RCW Chapter 77.55. Oregon LNG would consult with DSL, ODFW, Ecology, and WDFW regarding stream crossing methods and timing. DSL and Ecology place the highest priority on avoidance and minimization of impacts. Oregon LNG has avoided stream crossings wherever possible through careful Pipeline siting and design that minimizes impacts.

8.1 Onsite Mitigation

Onsite mitigation measures for stream channels are derived from the FERC Procedures; and from stream crossing drawings, supplemental descriptions, and stream bank restoration plans in Appendix 6A of the Applicant-Draft BA. Mitigation measures address potential effects on channel morphology and water quality.

8.1.1 Stream Channel Crossings

Stream crossings would be conducted in compliance with the FERC Plan and Procedures for Pipeline stream crossings. The crossings would be monitored after construction to ensure that bank stabilization methods employed were effective in abating increased sedimentation. A Stream Crossing Restoration and Post-Construction Monitoring Plan would be completed and submitted for agency approval before construction begins. Immediately after pipe installation and backfilling, and before the dams and flumes are removed and flow is returned to the waterbody channel, the stream banks would be reestablished to approximate preconstruction contours and stabilized. Erosion and sediment control measures would be installed across the construction easement to reduce stream bank and upland erosion and sediment transport into the waterbody.

8.1.1.1. Determine Crossing Methods

Stream crossing locations were carefully considered during Pipeline route selection to minimize impacts from the crossing method employed. Three crossing methods would be employed: HDD, open-cut trenching, and open-cut dry flume methods. HDD would be used on large streams and rivers; open-cut trenches would be used on streams that are dry at the time of construction; and open-cut dry flume methods would be used on smaller rivers and streams that contain water at the time of construction. Specific procedures for installing temporary bridges over waterbodies as well as construction methods for HDD, flume, and trench crossings are detailed in Resource Report 1, *General Project Description*.

Construction of the pipeline would cross numerous intermittent and perennial streams and rivers. A total of 120 streams crossed by the Oregon Pipeline have perennial flow regimes, support ESA-listed salmonids, or have designated critical habitat. Twenty-four of those streams support ESA-listed salmonids or have designated critical habitat. Some intermittent and ephemeral drainages not supporting ESA-listed salmonids would require further investigation before final engineering design.

There would be 13 HDD crossings. Site-specific stream crossing drawings for streams with ESA-listed fish are provided in Appendix 6A of the Applicant-Draft BA. Oregon LNG used the Washington Department of Natural Resources (WDNR) Watershed Analyses (1994) technique to evaluate stream morphologies in the Project area. Based on WDNR Standard Watershed Analysis Methodology, six channel types with the potential for either lateral (bank erosion causing channel migration) and/or vertical (debris flow) scour potential were identified for streams being crossed by the pipeline. Of the 24 perennial/ ESA stream crossings, 11 possess some potential for vertical scouring or debris flow events, while 23 have at least some potential for lateral channel migration.

Preconstruction surveys were conducted at crossing locations on ESA-listed and other select streams to evaluate design considerations needed to avoid and minimize impacts to channel morphology. Table 1 in the Technical Memorandum titled *Channel Response Matrix for Pipeline Crossings of Perennial Waterbodies and Streams Supporting ESA-Listed Salmonids* (located in Appendix F of this document) provides information important for estimating the susceptibility of individual channel types to morphological response, particularly vertical scour and lateral migration. These site-specific data were important in determining the type and feasibility of crossing methods at each stream crossing.

At Pipeline crossings containing ESA-listed fish or streams crossed within 0.1 mile of such streams, the Pipeline would be buried to a minimum depth of 3 feet (top of pipe). At streams with moderate to high scour potential, the Pipeline would be buried 3-feet deeper than the scour depth to ensure against exposure. The specific depth that would be required at such crossings would be determined on a site-specific basis, which would require acquisition of additional detailed information on substrate characteristics, expected peak flow conditions, local bed slope, and upstream and downstream conditions. These data would be acquired before final design of the high-risk crossings.

8.1.1.2. Implement Erosion Control Best Management Practices

Erosion control BMPs and the methods outlined in the FERC Plan and FERC Procedures would be implemented to reduce the potential for mass failure. In areas where landslides are a concern but specific landslide features cannot be identified, proper construction techniques would be implemented to minimize the potential for slope failure, landslides, or erosion resulting from Pipeline installation. In general, the installation of a Pipeline below ground (and subsequent backfilling of the trench zone with native material) results in a relatively short window of disturbance and minor change in subsurface conditions. The larger changes occur at the ground surface, where topography and vegetation are altered. Therefore, the majority of the construction techniques that would be implemented are performed to restore or improve the land and drainage features after construction is complete. These techniques may include the use of water bars, terracing, diversion ditches, and other methods to control runoff and erosion. Backfill operations would be performed to ensure that the trench backfill is adequately compacted so mounding is not required.

8.1.1.3. Avoid or Minimize Landslide Hazards

Revegetation procedures would be implemented to ensure rapid establishment of a vegetative cover after completion of construction. Where steeply sloped areas or mapped landslide hazard areas cannot reasonably be avoided, an effort has been made to align the pipe parallel to the maximum fall of the ground (that is, to run the pipe straight down the slope) and avoid placing the pipe parallel to the slope (that is, side-sloping the pipe). The potential for pipe damage because of soil deformations associated with rapid landslide movement is much less when the movement occurs parallel to the axis of the pipe. In areas where specific landslide hazards are identified, a number of methods are available for the mitigation of landslide deformation on pipelines. These include stabilization of the landslide, relocation of the Pipeline beyond the landslide, installation of the Pipeline above ground, installation below the landslide using directional drilling or deep excavation, or the use of deformable backfill such as polystyrene or other suitable material (Bukovansky and Major, 2002).

When avoidance measures are not practical, another option for mitigating the risks of landslide hazards includes maintaining the Pipeline within the landslide zone, which can be accomplished using a program of landslide and pipeline monitoring. This approach is particularly well suited to existing landslide areas where movement is occurring relatively slowly, which is the case in much of the landslide topography mapped throughout the Coast Range. Installation and monitoring of equipment to monitor the movement of landslides and pipelines (and the associated strain imposed on the Pipeline) is a common method of maintaining pipelines in active landslide zones. Vibrating wire strain gauges have been used extensively during the last 20 years to monitor longitudinal pipeline strain changes caused by the landslide deformations (Bukovansky and Major, 2002). Monitoring of pipeline strains enables sensitive measurements of forces in the pipe and timely implementation of strain-relief measures if strains reach a critical level. According to Bukovansky and Major (2002), federal, state, and local agencies that regulate pipeline construction and operation in the United States generally accept strain monitoring to provide for the safety of pipelines located in areas of geologic hazards. This has contributed to the acceptance of strain gauge monitoring as a basic system for enhancing pipeline safety.

The consequences of mass slope failures, landslides, persistent turbidity, and Pipeline fractures on fish and wildlife resources would depend on downstream physical and biological conditions and timing should a landslide or mass failure occur.

Because the severity of any given landslide with regard to ESA-listed fish is dependent on a nearly infinite number of variables, no generalities can be drawn. The effects could be as minor as a short-term pulse of turbidity that would require no corrective action or as severe as complete blockage of upstream migration. Should a landslide occur that is due to Pipeline construction and not other natural processes, ODFW, NMFS, and other interested parties would be consulted to design a site- and case-specific plan to mitigate any negative effects. By identifying potential landslide hazards in advance and developing appropriate engineering solutions to minimize the risk of landslides at sensitive sites, there should be minimal risk to listed fish from the effects of landslides at the open-cut or flumed stream crossings.

8.1.1.4. Crossing Methods

HDD Crossings

HDD crossing methods are a primary mitigation measure for avoiding and minimizing impacts to ESA or other fish-bearing and perennial streams. Locations of HDD crossings are listed in Table 5-1 (Section 5.0 above).

Site drawings for each of the proposed HDD crossing locations at ESA streams were provided to FERC in the June 2013 filing. The HDD crossings of ESA streams are typical of HDDs at non-ESA streams.

Surface-Water Crossings

Surface-water crossing methods for each stream were determined based on field surveys, review of fisheries data, and preconsultation meetings with the Services. Perennial streams would be crossed with the flume method on non-HDD streams. Stream flow may be channeled into one or multiple flume pipes to convey water across the trench and maintain downstream flow. The trench would be excavated from under the flume pipe, the Pipeline would be threaded under the flume, the trench would be backfilled, and the flume pipe would be removed to restore natural downstream flow. Figure 6A-26 in Appendix 6A of the Applicant-Draft BA shows the details of a typical flume crossing method. Temporary cofferdams would be constructed above and below the entry and outfall of the flume pipes. Before dewatering the work area, fish salvage would take place according to the *Oregon LNG Pipeline Waterbody Crossing: Fish Salvage Plan* technical memorandum originally submitted to FERC in 2008, and revised and resubmitted in June 2013 as Resource Report 3, Appendix 3O (see Appendix 2C of the Applicant-Draft BA for the June resubmittal version).

At stream crossings, the pipe would be buried at a depth to minimize the risk of exposure from vertical erosion or lateral migration. In the vertical dimension, the pipe would have a minimum of 3 feet of cover below the maximum scour depth. In the lateral dimension, the vertical depth would be maintained for a minimum length of 2.2 times the active channel width, plus the channel migration zone. For streams with floodplains less than 2.2 times the active channel width, the vertical depth would be maintained across the entire width of the floodplain.

Active channel migration zones and floodplains are applicable to streams with a gradient of less than 4 percent, because streams with a gradient of 4 percent or greater do not have functional floodplains (Rosgen, 1996). To prevent landslides at high-risk crossings, BMPs (including slope breakers, straw bales, silt fences, wattles, and subsurface drainage) would be used, as detailed in the technical memorandum titled *Landslide and Debris Flow: Relative Risk Assessment for the Bidirectional Project Pipeline* in Applicant-Draft BA Appendix 6B. Site-specific engineering techniques for minimizing landslide risk and for protecting the Pipeline against landslides, should they occur, are shown in drawings for each flumed and open-cut crossing that could affect ESA-listed fish. Should channel subsidence, bank erosion, channel scour, or other negative long-term effects of Pipeline construction become apparent during post-construction monitoring, case-specific responses would be tailored to alleviate the specific problems identified.

Stream bank erosion would be minimized by clearing the smallest amount of vegetation possible at stream crossings and grubbing only over the ditch line. Rootstocks would be left in place for erosion control and rapid post-construction vegetative regeneration, in addition to seeding and mulching, planting native vegetation (where necessary), and—in some cases—use of biodegradable erosion control fabrics.

The open-cut trenched method is applicable to intermittent and ephemeral streams that are not fish bearing, and to fish-bearing intermittent or ephemeral streams if dry at the time of construction. Applicant-Draft BA Figure 6A-27 in Appendix 6A shows the details of a typical open-cut trenched crossing method. This method is allowable for the crossing of minor or intermediate waterbodies. The restrictions on instream work, restoration of preconstruction contours, limitations on equipment operating in the waterbody, or required bridging identified in the FERC Procedures would be practiced as follows:

- Limit the use of the equipment operating in the waterbody to only the needed equipment.
- Return the waterbody to its preconstruction contours.

Other general measures to be applied for surface-water crossings are as follows:

- Stabilize channel banks and install temporary sediment barriers within 24 hours after completing the crossing.
- Perform pipe stringing, pipe bending, and welding greater than 25 feet on each side of the stream.
- Give clearing crews specifications for minimizing riparian clearing to accommodate stream size, terrain, and existing vegetation conditions, and to avoid removal of significant trees, where possible, at the margins of the temporary construction zone.
- Occasionally require a wider riparian clearing width to cross streams in steep terrain. To account for larger trench backslopes and perform temporary grading for equipment access, limit clearing for steep terrain crossings to the minimum clearing width to safely perform access and construction.
- Salvage existing LWD for reinstallation, and stockpile a sufficient quantity of large-diameter conifer logs for post-construction aquatic habitat enhancement.
- Upon completion, regrade and stabilize stream banks, and restore the riparian area with native vegetation (see stream bank restoration plan in Applicant-Draft BA Appendix 6A).
- Segregate topsoil, nontopsoil substrate, instream spoils, and LWD and maintain it near the crossing locations for backfilling and restoration activities. Take care to segregate substrate by grain size so that streambeds can be restored with their original substrate following pipe installation.
- For open-flume crossings, remove temporary “bridges” used for construction following construction. It is Oregon LNG’s intention to remove these bridges and maintain access to the Pipeline easement by the listed access roads. Temporary bridges would only be in place during the late spring and summer dry season. Only if there is a Pipeline concern under a waterbody would post-construction reentry be considered.

8.1.2 Applicant and Contractor Responsibilities

8.1.2.1. Oregon LNG

Throughout the construction phase, Oregon LNG would ensure that the contractor is following prescribed methods and is conducting operations in accordance with the final Construction, Restoration, and Monitoring Plan and applicable permits and regulations. Oregon LNG would mark waterbody crossings before construction and would ensure that the contractor is aware of procedures related to sensitive wildlife habitats, and has sufficient supplies to address any unforeseen complications that arise. Oregon LNG would require that the contractor maintain sufficient supplies and equipment to complete construction in accordance with the FERC Plan and Procedures and the final Construction, Restoration, and Monitoring plan. These supplies would include spill control and cleanup devices (absorbent pads, socks, and “kitty litter” type granules), silt fencing, straw bales, and other erosion control devices. Erosion controls would be carefully monitored during construction to ensure that excessive sediment discharge to streams is avoided. Oregon LNG may have several representatives at the construction site at any one time, but one staff member would be designated as the environmental inspector (EI).

The EI would be responsible for maintaining compliance with the FERC Plan and Procedures, the final restoration and monitoring plan, and any other regulations as specified in OARs. The EI would ensure that in-water work periods are observed and that markings and flagging remain in place during construction. The EI would have “stop work” authority in the case of any activities by the contractor not allowed under the final Construction, Restoration, and Monitoring plan. The EI would supervise construction activities in waterbodies including installing dams and flumes, fish salvage, and stockpiling/replacing soils, boulders and LWD. The EI would also be responsible for overseeing stream restoration and mitigation activities. The EI would ensure that crossings are graded to preconstruction contours, that temporary and permanent erosion control devices are installed, that crossings are revegetated in accordance with revegetation plans, and would have final say regarding the “completeness” of restoration activities. Oregon LNG would also be responsible for the long-term soil stabilization, restoration, and monitoring of stream crossings.

8.1.2.2. Contractors

Oregon LNG would engage one or more contractors for construction, reclamation, revegetation, and monitoring. The construction contractor would be responsible for all phases of construction. This would include procuring sufficient supplies to complete construction on schedule, maintaining equipment in good working order, and following procedures in the final Construction, Restoration, and Monitoring plan. Specific to stream crossings, the contractor would be responsible for installing erosion control devices (silt fence, straw bales, or other sediment barriers), installing temporary equipment crossings, segregating spoils (including topsoil, LWD, and other up-land and instream spoils), installing flumes, stringing pipe, backfilling trenches, and restoring banks and streambeds.

8.1.3 Preconstruction Site Characterization and Documentation

The purpose of the preconstruction assessment is to establish a baseline sufficient to determine whether post-construction restoration is effective in returning streams to their preconstruction functional ability. As such, the preconstruction assessment is not designed to be a comprehensive characterization of wildlife habitats or vegetation present at each stream crossing. The method employed would be largely subjective in nature, relying on observations by experienced biologists. A key component of the monitoring program would be “before and after” photographs. Procedures for photo documentation would follow Edelen and Crowder, 1997.

Before construction, each stream crossing location would be assessed and documented using the following methods (Rashin, Bell, and Clishe, 1993; Federal Interagency Stream Restoration Working Group [FISRWG], 1998; OWEB, 1999; and Oregon Plan for Salmon and Watersheds, 2004):

1. Stream crossings would be assigned a unique identification number. A whiteboard or similar suitable sign would be prepared with the date, time, and crossing identification (ID) number to identify the crossing location, and would be placed in photographs. Each crossing location would be photographed from multiple angles and care would be taken to document adjacent upstream and downstream channel segments. Efforts would be made to photograph significant habitat features such as over-hanging banks, root-wads, LWD, boulders, and stream substrate.

2. A data sheet would be completed at each stream crossing. Information recorded would include bank substrate and condition, streambed substrate, stream morphology, dominant bank vegetation, percent bankfull discharge at the time of assessment, LWDs or other instream structures, and a narrative describing the crossing location in as much detail as possible. A site sketch would be completed on the data sheet, and photographs taken would be described. The site sketch would include features that were photographed and an indication of the photographer's location at the time of each photo (for example, a labeled photo with an arrow to indicate the direction of the photograph).

During preconstruction site characterization, Oregon LNG would identify and mark potential donor plant sites at adjacent areas where replacement vegetation may be obtained for use in restoration activities.

8.1.4 Stream Channel Restoration Measures

8.1.4.1. Schedule

The construction schedule would adhere to the recommended ODFW in-water work periods unless an extension of those work periods is granted. In-water work periods by Pipeline mile and river/basin are shown in Table 8-1. As indicated in the table, the start and end dates are variable depending on the region and the stream; start dates are as early as April and end dates are as late as October.

Oregon LNG would complete flume method stream crossing construction in perennial streams in 3 days or less. In accordance with the FERC Procedures, the duration of in -water construction would be limited to 24 hours across minor waterbodies (10 feet wide or less) and 48 hours across intermediate waterbodies (between 10 and 100 feet wide). Bank restoration would follow as quickly as is technically possible. Final cleanup would include regrading, mulching, placing erosion control mats, reseeding or transplanting vegetation. Reseeding and reclamation would be accomplished as quickly as possible following pipe installation. In the event that precipitation events or other force majeure complications preclude the completion of seeding and reclamation within 10 days, exposed erodible substrates would be covered with straw or other suitable mulch until seeding is completed and seedlings are established as described below.

Oregon LNG would follow the FERC Procedures to limit water quality effects on waterbodies during construction. Oregon LNG would also implement erosion and sediment control measures as described in Figures 6A-26 through 6A-31 in Applicant-Draft BA Appendix 6A to control soil erosion and sediment discharge. In addition, Oregon LNG would obtain an NPDES 1200-C construction stormwater discharge permit before construction of the Project.

8.1.4.2. Regrading

Following Pipeline installation, areas disturbed during construction would be returned to their preconstruction contours. Trenches would be backfilled and topsoil would be replaced as close as possible to the location from which it was excavated. The original profiles, meanders, and contours would be reconstructed, except for very steep bank profiles. Steep banks may be graded to a stable angle of repose to prevent erosion.

Excess rock that cannot be returned to the trench or used for slope stabilization, and is not utilized as instream structure for habitat mitigation/enhancement, may be distributed throughout the right-of-way or be utilized as a barrier to block unauthorized vehicular access to the right-of-way. No solid waste or construction debris would be allowed to remain in the right-of-way following final regrading.

8.1.4.3. Erosion Control

Temporary and permanent erosion control would be deployed during and after the Pipeline installation. The specific temporary erosion control methods used would be based on site specific requirements related to bank slope and substrate conditions. Individual HDD crossing drawings containing detailed plans for the location and type of erosion control structures to be applied at those locations.

The following potential stream bank stabilization BMPs would be used after construction at stream crossings regardless of whether they are flowing or dry at the time of construction:

- Use clean gravel or native cobbles for the upper 1 foot of trench backfill in waterbodies that contain coldwater fisheries.

- For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For flume crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.
- Return waterbody banks to preconstruction contours or to a stable angle of repose, as approved by the EI.
- Employ primarily bioengineering techniques for bank armoring and protection. Apply site-specific BMPs, such as those described by McCullah and Gray (2005).
- Riprap shall not be used for bank stabilization unless a geotechnical or environmental engineer determines that alternative soft armoring methods would be inadequate. If riprap is used, it shall be limited to the minimum required stream length.
- Revegetate disturbed riparian areas with conservation grasses and legumes or native plant species, preferably woody species.
- Install a permanent slope breaker across the construction easement at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody.
- At dam and pump and flume crossings, repair unavoidable streambed scour at pump discharges with clean gravel.
- Remove all non-native materials from the crossing after construction and stabilization are complete.

8.1.4.4. Revegetation

Banks would be revegetated according to the plan submitted in the Applicant-Draft BA, Appendix 6A to stabilize soils and prevent erosion.

8.1.4.5. LWD Placement and Other Restoration/Mitigation Activities

If LWD is removed from the streambed during construction, it would be stockpiled until construction is completed and then replaced. The EI would be responsible for ensuring that the LWD is appropriately anchored to prevent it from displacing downstream and that post-construction placement would provide similar habitat benefits to preconstruction conditions. Large trees removed from the construction right-of-way would also be stockpiled for use in post-construction operations.

8.1.5 Restoration Documentation

Following the completion of reclamation activities but before post-construction monitoring begins, Oregon LNG would perform a final inspection of the crossings to verify that preconstruction commitments have been satisfied. When the inspection is complete, Oregon LNG’s construction or restoration contractor would be notified of any required remedial actions. During the post-construction site visit, temporary erosion control devices (such as silt fences) that are no longer required would be noted and Oregon LNG would contract for their removal. In the event that temporary erosion control devices are still required, but are in poor repair, Oregon LNG would repair or replace them as necessary.

A post-construction report demonstrating “as-built” conditions is required under OAR 141-085-0151(2)(a) for compensatory mitigation, and Oregon LNG would submit a similar report within 90 calendar days of completing grading, reclamation, and revegetation. The report would include details on final grading and a discussion of any variation from the approved plan.

Information would be provided on the date and duration of each stream crossing, an explanation of any crossings that exceeded the 24-hour preferred construction duration, a description of reclamation activities (temporary and permanent erosion control, excess rock placement, remediation activities, and revegetation), and any deficiencies (that is, obvious erosion) noted during the initial post-construction inspection. Appendix G in this Plan contains drawings of typical non-ESA-listed stream crossings.

8.1.6 Water Quality

Oregon LNG would follow the FERC Procedures to limit water quality effects on waterbodies during construction. Oregon LNG would also implement erosion and sediment control measures as described in Figures 6A-26 through 6A-31 in Applicant-Draft BA Appendix 6A to control soil erosion and sediment discharge. In addition, Oregon LNG would obtain an NPDES 1200-C construction stormwater discharge permit before construction of the Project.

The SWPPP is provided in Appendix B. The locations of site-specific erosion control and BMPs are identified in typical stream crossing drawings. Typical details are listed in the figures. The SPCC Plan includes information regarding the containment of drilling mud during HDD wetland and waterbody undercrossings.

During preconsultation discussions with USFWS and NMFS, it was agreed that unless approved by USFWS, NMFS, and ODFW, ATWS would be set back 150 feet from perennial streams and wetlands. In addition, overnight parking of vehicles, storage of fuels and other hazardous materials, and refueling activities would take place no closer than 150 feet from a stream or a wetland, unless full containment of potential contaminants is provided. Under certain clearly defined conditions, and subject to agency approval, ATWS may be placed closer to waterbodies or wetlands where the ATWS placement would not increase effects on streams or fish habitat.

During the construction of the Project across perennial streams, measures to avoid construction-related impacts would include placing spoils at least 50 feet from the water's edge for streams without water or in ATWS 150 feet from perennial streams; using erosion and sediment controls to prevent the excessive delivery of sediment to waterbodies; and, where temporary vehicle crossing is needed, following the FERC Procedures for temporary equipment bridges.

8.1.6.1. Increased Sediment Inputs

Within the construction easement, erosion and sediment control measures would be installed to reduce post-construction stream bank and upland erosion and sediment transport into the waterbody, thus eliminating concerns for excessive sediment transport from uplands into the streams. The erosion and sediment control methods would be maintained until vegetation is established within the riparian zone. Stream bank restoration and monitoring would be conducted in accordance with the Restoration and Monitoring Plan to be completed before construction begins.

The Project would use methods adopted from FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* to minimize effects from construction operations on slopes and to prevent soil erosion. The Project would also comply with the ODEQ Erosion and Sediment Control Manual (ODEQ, 2013) and the Oregon Department of Transportation (ODOT) Erosion Control Manual (ODOT, 2005). The adapted version of the FERC Plan is presented in Appendix 7G of Resource Report 7 (Oregon LNG, 2013).

The FERC Plan, as well as the state of Oregon guidance documents, specifies BMPs to reduce sediment discharge from construction sites. These BMPs include the use of terraces, mulch (e.g., hay and straw), mulch anchored with a light asphalt tack, or mats in areas where a high erosion potential exists. The FERC Plan also specifies the use of seeding mixtures that would ensure rapid revegetation. These consist of species adapted to the various conditions encountered along the Pipeline easement, including wet and shady areas and areas with shallow soils.

Sediment barriers would be installed immediately after initial disturbance of the waterbody or adjacent upland. In areas where the Pipeline alignment crosses steep slopes, the need for additional erosion control measures, above and beyond those required by state and federal agencies, would be evaluated on a case-by-case basis. Construction would be conducted in the late spring to early fall, and revegetation of exposed areas would occur immediately to avoid exposure of bare soils during the winter rainy season.

Restoration procedures would be monitored to ensure their efficiency and effectiveness. If the monitoring identifies any areas of erosion or ineffective revegetation, the easement would be restored in accordance with the existing plans unless it is determined that modified plans are needed, in which case NMFS and ODFW would be contacted for approval of any such modifications. Sediment barriers would be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls, or until restoration of adjacent upland areas is complete and revegetation has stabilized the disturbed areas.

8.1.6.2. Water Temperature

The streams that are listed (1972 Clean Water Act § 303(d)) as temperature sensitive along the Pipeline would be crossed using HDD, thereby avoiding loss of streamside shade in these temperature-sensitive streams. At flume and open-cut crossings, the removal of riparian vegetation would be minimized to the extent possible. However, even in the event that the full 100-foot construction corridor is cleared, it is unlikely based on the technical memorandum in Appendix 10 of the Applicant-Draft BA, *Oregon LNG: Characterizing Deforestation Impacts on Stream Temperature* (CH2M HILL, 2009), that the resultant increase in incident solar radiation would be sufficient to cause biologically significant increases in downstream water temperatures. Revegetation of the easement over the long term (described above) would eliminate any small increases in water temperature that do result.

8.2 Compensatory Mitigation

A post-construction report demonstrating "as-built" conditions is required under OAR 141-085-0151(2)(a) for compensatory mitigation, and Oregon LNG would submit a similar report within 90 calendar days of completing grading, reclamation, and revegetation. The report would include details on final grading and a discussion of any variation from the approved plan.

Information would be provided on the date and duration of each stream crossing, an explanation of any crossings that exceeded the 24-hour preferred construction duration, a description of reclamation activities (temporary and permanent erosion control, excess rock placement, remediation activities, and revegetation), and any deficiencies (that is, obvious erosion) noted during the initial post-construction inspection. Appendix G in this Plan contains drawings of typical non-ESA-listed stream crossings.

8.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

Post-construction monitoring would be conducted twice during the first year following construction at approximately 6-month intervals and annually thereafter for a total of 5 years or until successful reclamation is complete, whichever is longer.

The objectives of the post-construction monitoring program are twofold:

1. To ensure that stream crossing locations are able to fulfill their preconstruction functions by documenting and correcting problems with bank stabilization and revegetation; and
2. Document the success of LWD placement or other habitat enhancement activities completed as part of the mitigation plan. Further details regarding mitigation would be provided upon final selection of mitigation sites and methods.

Objectives would be accomplished by evaluating the following:

- Growth of riparian vegetation compared to preconstruction conditions, based on species representation, cover, and vegetative structure
- Vegetative conditions in the 10-foot-wide vegetated zone over the Pipeline and the effects of maintenance mowing
- Height of trees and shrubs; assess whether they have attained a height of at least 15 feet in the 30-foot-wide vegetated zone centered over the pipe (except for the 10-foot-wide mow strip)
- Relative condition and dominance of reestablished native trees and shrubs in the Pipeline corridor and the riparian buffers
- Vegetative conditions in relation to the revegetation plan and FERC requirements

- Presence and abundance of noxious weeds and the effectiveness of control measures in the adjacent buffer; and the within the Pipeline corridor
- Effectiveness of erosion control applications to stabilize soil and prevent excessive erosion
- Retention of important specimen trees, significant wildlife snags, nest trees, downed large wood, and rocks in riparian areas and stream bank zones

Monitoring would be conducted to assess streams at the same time of year as their preconstruction site visit. The post-construction monitoring would focus on identifying problems with bank stabilization and revegetation.

During post-construction monitoring events, Oregon LNG or a contractor would look for trench subsidence and erosion indicators such as gullies, undercutting banks, bare ground, bank slumping, and evidence of sheet erosion. If initial erosion control features are shown to be inadequate or if erosion control structures fail, Oregon LNG would retain a contractor to conduct remedial actions as soon as site conditions allow.

Repairs or remedial actions could include additional seeding or transplanting, installing more robust erosion/ sediment control materials, maintaining or replacing the initial erosion control features, placing boulders or LWD, slope armoring, additional mulching, or matting. If trench subsidence is observed, Oregon LNG would direct the contractor to fill and compact the trench to grade with appropriately sized substrate. If trench remediation is required below the ordinary high water mark, activities would be conducted within appropriate ODFW in-water work periods.

Revegetation monitoring would include a qualitative assessment of the following parameters in comparison to adjacent undisturbed areas:

- Percent total adjacent herbaceous cover (seeded/transplanted species plus desirable volunteers)
- New or expanded populations of noxious weeds
- Species composition

Post-construction surveys would be conducted by experienced biologists. The assessments would include photo documentation and completion of data forms for reporting and documentation.

8.3.1 Performance Standards

Criterion for establishing adequate vegetation recruitment would be defined in the final Construction, Restoration, and Monitoring Plan following consultation with ODFW and DSL. For example, areas may be considered successfully reestablished if, after the first year, disturbed areas contain at least 50 percent of the herbaceous cover as adjacent undisturbed areas, with no bare spots greater than 2 feet in any dimension and the species composition is a mixture of seeded or replanted species and desirable volunteers. At the end of 5 years, success may be defined as at least 80 percent of the herbaceous cover as adjacent undisturbed areas.

Areas with poor reestablishment or undesirable species mixes would be evaluated to determine, if possible, the cause of the problem (that is, poor germination, poor planting technique, herbivory), and corrective measures would be undertaken. Potential corrective measures include replanting, planting an alternative species mix, or protecting existing seedling from herbivory.

The reclaimed right-of-way would be considered stable when the surface appears similar to adjacent undisturbed land and the following accelerated erosion indicators do not exist:

- Perceptible soil movement (exceeding preconstruction conditions)
- Flow pattern development resulting in rills or gullies greater than 3 inches deep
- Evidence of sheet erosion
- Evidence of siltation in stream substrates downstream of the crossing
- Perceptible downstream movement of instream rock or woody debris
- Trench subsidence or slumping

8.3.2 Reporting

Following each monitoring period, Oregon LNG would prepare a report for submittal to the DSL. The report would contain the following:

- Summary of bank vegetation recruitment and species composition as compared with adjacent undisturbed areas
- Assessment of the condition of transplants in riparian areas
- Discussion of non-native species and noxious weeds in disturbed areas
- Description of any deviations from the monitoring plan
- Discussion of Project performance and an assessment of whether Project goals are being met
- Any observations not included on monitoring forms that further elucidate the success or potential for failure of revegetation and restoration efforts
- Identification of areas that require remedial action
- Recommendations and schedule for remedial action(s)
- Before and After photo pairs for each crossing
- Monitoring forms

If success criteria have not been met by the end of year 5, Oregon LNG would consult with agencies to determine future actions. Actual contingency measures would be based on monitoring data and site circumstances as they occur.

8.3.3 Adaptive Management Summary

Adaptive management at stream and river crossings would address both unanticipated emergencies (e.g., landslides into the stream channel, exposure of the Pipeline through streambed scouring, and frac-outs during HDD drilling operations) and compliance with proposed restoration goals. A comprehensive post-construction monitoring plan and SPCC plan for stream crossings is included in Resource Report 2, Attachment 2H.

8.3.3.1. Frac-outs

Adaptive management for frac-outs is thoroughly addressed in the SPCC plan and includes steps such as the following:

- Depending on the severity of the release, the most common first step for the HDD contractor in reestablishing circulation and sealing fractures is to utilize a thicker, lower-viscosity mixture of sodium bentonite and water. The thicker mix of sodium bentonite and water would be more effective in forming a filter cake on the inside wall of the borehole and soil/rock particles around the borehole to seal voids and prevent further release of drilling mud. In some cases, un-hydrated sodium bentonite chips would be pumped through the drill rods. These granules of bentonite would flow in and fill or bridge a void or fracture. They would hydrate and swell in the presence of the drilling fluid to seal off leaks or fractures.
- If the problem is more severe, standard drill fluid additives would be used. These drill fluid additives commonly consist of PAC, or water–swellable synthetic polymers capable of absorbing many times their weight in water. These materials work in a similar manner as the granular bentonite, that is, they are pumped through the drilling system and allowed to swell to seal voids and fractures.
- In the most severe cases, standard drill fluid additives may not be sufficient to seal fractures and reestablish circulation of drill fluid. In these conditions, coarser bridging agents may be required. These bridging agents may take the form of fiber, flake, or granular materials (Canon, 2003). Examples of fiber additives are cellulose fiber, cedar (or other wood) fiber, cane fiber, or spun mineral fiber. Mica is one of the most common examples of flake additives. Granular additives include nut hulls and granular bentonite (discussed above). Most of these bridging agents come in different sizes from coarse to fine and many manufacturers of drill fluid

additives provide specially designed materials that may contain a combination of various bridging agents and polymers.

Should the above methods prove unsuccessful, and HDD drilling fluid is released to water, appropriate local, state, and federal agencies would be notified, and a determination on whether or not to cease operations would be made in accordance with the SPCC Plan. The extent of the release would be assessed, and appropriate corrective actions would be taken. These corrective actions may range from simple monitoring in the case of small releases, to active cleanup using specialized pumps and filters, to abandonment of the HDD and sealing of the hole. In the event of an HDD drilling fluid release to land, the release and drilling hole entry point would be contained with berms, pumps, hay bales, sediment fencing, wood products, or other appropriate means, and the fluid would be cleaned up immediately using hand tools or vacuum trucks and transported to an approved disposal location.

8.3.3.2. Mass Failures

The steps to be followed in the event of a mass failure would be outlined in the Post Construction Monitoring Plan. Because the severity of any given landslide to ESA-listed fish is dependent on a nearly infinite number of variables, no generalities can be drawn. The effects could be as minor as a short-term pulse of turbidity that would require no corrective action, to complete blockage of upstream migration. Should a landslide occur, that is due to Pipeline construction and not other natural processes, the Interagency Adaptive Management Team would be consulted to design a site- and case-specific plan to alleviate the problem and mitigate for any negative impacts.

8.3.3.3. Streambed Scour/Pipeline Exposure

Should channel subsidence, bank erosion, channel scour, or other negative long-term effects of Pipeline construction become apparent during post construction monitoring, case-specific responses would be tailored to alleviate the specific problems identified. The post-construction monitoring plan would outline the steps to be followed in the event that Pipeline exposure is discovered. The steps would likely include first stabilizing the exposed pipe, followed by consultation with the agencies on the most effective course of action. Depending on the timing and circumstances, the methods followed may be significantly different. For instance, should the scour occur during the in-water work period, the most effective and least destructive course of action may be immediate reburial at a greater depth, but should the scour become apparent during sensitive spawning or migration periods, different options may be pursued.

8.3.3.4. Compliance with restoration goals.

The Post Construction Monitoring plan has yet to be completed. However, adaptive management would be an integral component of the overall strategy to meet mitigation goals. The plan would lay out steps to follow should any of the mitigation or restoration efforts (e.g., LWD placement, bank revegetation, fish passage improvements) prove less effective than anticipated, or should the negative effects be greater than anticipated (for instance, if more fish are salvaged than predicted in the Applicant-Draft BA).

Monitoring would be conducted, and reports would be filed annually with ODFW, DSL, and other interested parties, outlining the state of restoration efforts, and discussing any proposed alterations/refinements to the overall plan based on any deficiencies identified.

SECTION 9

Marine Reptiles and Mammals

Section 4.0 in the Applicant-Draft BA provides the basis for mitigation measures recommended for marine reptiles and mammals.

9.1 Onsite Mitigation

Onsite mitigation measures for marine mammals and marine reptiles are proposed in the following sections.

9.1.1 Marine Mammals

9.1.1.1. Nonlisted Seals and Sea Lions

Underwater noise mitigation measures may not reduce noise levels below established thresholds. Since seals and sea lions are known to swim past the ESP, there is potential for individuals to be exposed to harming noise. The proposed action is likely to harass, but not adversely affect seal and sea lion population numbers. This effect would be restricted to, at most, two in-water work periods when pile driving would occur. Oregon LNG would apply for an Incidental Harassment Authorization (IHA) for level B harassment on pinnipeds.

The reduced speed limits proposed as a conservation measure to minimize whale strikes would benefit the seals and sea lions. LNG ships would slow to speeds below 15 knots as they approach the mouth of the Columbia River. If a spill were to occur, Oregon LNG would immediately report the incident and take recommended actions to prevent or minimize effects on marine life.

Measures would be taken to reduce the potential effects of underwater noise on seals and sea lions. Pile driving would occur only during daylight hours. The actual number of hours of pile driving each day is not expected to exceed 4 hours because of mobilization time for each pile. Vibratory driving would be used where it is practical. Density of substrates would determine the extent to which vibratory driving can be used for each pile. Vibratory pile driving cannot be used alone, as impact driving would be required to test each pile. In an effort to reduce noise levels during impact driving, the Project anticipates installing mitigation measures to achieve approximately a 15 to 20 dB reduction. Proposed sound attenuation measures are bubble curtains, confined bubble curtains, pile hammer cushions, dewatering caissons, or cofferdams. CH2M HILL outlined underwater noise monitoring protocols in detail in the *Oregon LNG Terminal and Oregon Pipeline Project—Underwater Noise Propagation, Monitoring, and Mitigation* (Applicant-Draft BA Appendix 8). Monitoring protocols call for monitoring underwater noise, monitoring for the presence of seals and sea lions, and ceasing pile driving if seals and sea lions are visible within the zone where underwater noise exceeds the harassment threshold.

LNG vessels transiting to or from Asia would follow a Great Circle route and would not be in proximity of designated critical habitat. Cargo and tanker vessels typically transit about 50 miles offshore (Cameron, 2008; Applicant-Draft BA Tables 4.3-1 -4.3.3). LNG vessels are expected to follow a similar pattern of transit along the West Coast. Therefore, LNG vessels are expected to be many miles offshore from rookeries that are designated critical habitat, thus adverse effects are unlikely.

9.1.1.2. Whales

The technical memorandum in Applicant-Draft BA Appendix 11, *Oregon LNG: Estimate of Potential Whale Strikes* (CH2M HILL, 2013) addresses provides the basis for mitigation measures related to potential impacts to whales.

Ship collisions involving whales are uncommon but possible. Depending on the known occurrence and relative abundance of select species in the Project area, the proposed action could adversely affect whales. The proposed action is not likely to adversely affect critical habitat, nor would the proposed action adversely affect the suitability of any occupied (seasonally or permanently) habitats. The proposed action would not degrade unoccupied habitats. Effects on whales analyzed in the Applicant-Draft BA include the following:

- Sei Whale (Federal, Endangered; State, Endangered)
- North Pacific Right Whale (Federal, Endangered; State, Endangered)

- Blue Whale (Federal, Endangered; State, Endangered)
- Fin Whale (Federal, Endangered; State, Endangered)
- Humpback Whale (Federal, Endangered; State, Endangered)
- Killer Whale (Federal, Endangered; State, Not Listed)
- Sperm Whale (Federal, Endangered; State, Endangered)

Oregon LNG would adopt the following vessel strike avoidance measures suggested by the NMFS (NMFS, 2008d) and recommended for inclusion in the Terminal Users agreement with LNG vessels:

- Vessel operators and crews should post watch for the detection of whales to avoid striking sighted animals.
- When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.
- Reduce vessel speed to 10 knots or less when whales are observed near the vessel, as safety permits.

Oregon LNG would also adopt the following NMFS recommend measures for reporting any whale strikes (NMFS, 2008d).

- Vessel crews must report sightings of any injured, entangled or dead whales as soon as possible, regardless of whether the injury or death is caused by your vessel.
- Report to the Northwest Mammal Stranding Networks
- If your vessel is responsible for injury or death of a whale, notify the USCG to report the incident and request the information be relayed to NMFS, Northwest Regional Office.

The report should include the following information:

- Time, date, and location (latitude/longitude) of the incident
- Name and type of the vessel involved
- Vessel's speed during the incident
- Description of the incident
- Water depth
- Environmental conditions (e.g., wind speed and direction, sea state, cloud cover, and visibility)
- Species

As ships approach the Columbia River, they would slow to speeds below 15 knots. At slower speeds, collisions with whales would be even less likely to occur. In the event of a ship strike or spill, Oregon LNG would immediately report the incident and take actions to mitigate or eliminate effects on whales.

9.1.2 Marine Reptiles

The proposed action may affect sea turtles, but is not expected to affect their population or habitat. No effect on the suitability of seasonally or permanently occupied or unoccupied habitat, or critical habitat is anticipated. Effects on sea turtles analyzed in the Applicant-Draft BA include the following:

- Green Sea Turtle (Federal, Endangered; State, Endangered)
- Leatherback Sea Turtle (Federal, Endangered; State, Endangered)
- Loggerhead Sea Turtle (Federal, Threatened; State, Threatened)
- Olive Ridley Sea Turtle (Federal, Threatened; State, Threatened)

Conservation measures proposed for avoiding and minimizing strikes to whales would also minimize effects on sea turtles. No additional species-specific conservation measures are prescribed.

9.2 Compensatory Mitigation

For the marine mammals analyzed, potential conflicts with shipping could occur, and Steller sea lions could be disturbed by construction impacts at the Terminal. Therefore, expected adverse effects on individuals are likely. Methods for monitoring and mitigating for underwater noise are discussed in the technical memorandum in

Applicant-Draft BA Appendix 8 titled *Oregon LNG Terminal and Oregon Pipeline Project—Underwater Noise, Propagation, Monitoring, and Mitigation* (CH2M HILL, 2011).

Effects on seals and sea lions would be restricted to, at most, two in-water work periods when pile driving would occur. Oregon LNG would apply for an IHA for level B harassment on pinnipeds. Effects on critical habitat are unlikely. Therefore, a not likely to adversely affect determination is warranted for critical habitat.

Effects on whales and marine reptiles are not expected because no critical habitat would be impacted, and the suitability of occupied habitat would not be negatively affected. Therefore, the proposed action is not likely to adversely affect whales and marine reptiles, nor is it expected to degrade unoccupied habitats. Thus, no species-specific compensatory mitigation is needed for whales and marine reptiles.

9.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

Unanticipated events could include incidental lethal take of seals and sea lions, incidental take (ship-strike) of a sea turtle, and whale strikes over and beyond that which is predicted. Oregon LNG outlined monitoring and reporting procedures during pile driving in the technical memorandum titled *Oregon LNG Terminal and Oregon Pipeline Project—Underwater Noise, Propagation, Monitoring, and Mitigation* (Applicant-Draft BA Appendix 8; CH2M HILL, 2011) and reporting procedures for whale strikes in the conservation measures section (Section 9.1.1.2, above).

Appropriate adaptive management would begin with an evaluation of the circumstances surrounding the unanticipated events. For example, if whale strikes are higher than predicted, then a number of factors would be evaluated including vessel speeds, whale population numbers, locations of strikes, and volumes of ship traffic, and LNG whale strikes in proportion to other vessels. Potential adaptive management would be dependent on the results of the analysis and could include altering ship speeds or routes. The adaptive management strategy would differ depending on the analysis. For example, increased whale strikes as a result of increased whale populations and constant ship traffic might be treated differently than increased whale strikes in the context of constant or declining whale populations.

SECTION 10

Migratory Birds

Mitigation measures for migratory birds were developed using the *Migratory Birds—Regulatory Review and Mitigation* technical memorandum submitted as Appendix 3P to Resource Report 3 (Oregon LNG, 2013) and included as Appendix H in this Plan.

The MBTA (50 CFR 10.13) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior.

While the MBTA has no provision for allowing unauthorized take, the USFWS recognizes that some birds may be taken during activities such as Pipeline construction even if reasonable measures to avoid take are implemented. The USFWS's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

Oregon LNG recognizes that construction of the Project and maintenance of the permanent right-of-way for the Pipeline may result in direct impacts to migratory birds and impacts to the habitats upon which they depend for various life requisites. Oregon LNG also recognizes that because of the size of the Project and the fact that some construction and operation would occur during the nesting season for a majority of migratory bird species found in the Project area, take of active nests, (i.e., eggs and young) may occur in spite of reasonable efforts to avoid such take.

Oregon LNG is committed to taking reasonable measures to comply with the MBTA and would commit to providing preservation of habitats for migratory birds in the vicinity of the area where the Pipeline would be constructed, operated, and maintained. Accordingly, Oregon LNG has prepared this summary of efforts to comply with the MBTA.

The list of migratory birds of concern in Table 10-1, adapted from a list provided by the USFWS, includes state and federal listed species, Oregon birds of conservation concern, and other migratory birds that are known or suspected to occur in the action area.

10.1 Onsite Mitigation

Clearing of vegetation before construction would occur in the spring, when many birds are nesting. Clearing outside of the breeding season for most migratory birds (that is, April 15 to August 15) poses its own risks and limitations. For example, clearing in the early spring or late summer/fall could be challenging for workers who need to establish effective erosion control on bare ground during the rainy season. The likelihood of causing mortality to nesting birds is moderate to high if felling trees and land-clearing takes place during the bird-nesting season. However, there is reduced risk of soil erosion if land is cleared at the end of the rainy season.

Generally, Pipeline construction would follow FERC's Plan and Procedures, except where inappropriate, infeasible, or where unsuitable conditions prevail. The Plan and Procedures help the Project to avoid, minimize, and mitigate potential impacts to wildlife and wildlife habitat by establishing best practices for Pipeline construction. In the event that construction activities differ from the approved actions within the Plan or Procedures, Oregon LNG would request a variance from FERC before beginning construction.

Oregon LNG would avoid or minimize overall impacts to migratory bird habitat by constructing the Terminal on sandy dredge spoils, much of which is devoid of vegetation, and where vegetated, covered by poor quality nesting habitat (Scotch broom and Himalayan blackberry). The Pipeline was sited primarily in industrial forest in Oregon and agricultural land in Washington that does not contain blocks of old-growth forest typically associated with interior forest species, northern spotted owls, and marbled murrelets.

Oregon LNG would perform 13 HDDs for Pipeline installation. Avoidance of habitat impacts, particularly riparian areas, would occur over a total of 12.3 miles or about 9 percent of the Pipeline as a result of using the HDD construction method. Entry and exit points were sited to be outside forested riparian vegetation.

At stream crossings using trenching and fluming methods, riparian vegetation clearing typically would be 100 feet wide to account for workspace requirements for steeper terrain. Many stream crossings would be reduced to a width of 75 feet (see Section 2 of the Applicant-Draft BA).

Riparian clearing is required for equipment access, temporary equipment bridges, installation and removal of fluming materials, trench backslopes, pipe capping (if used), and soil handling. Soil stockpiling, pipe stringing, pipe bending, and welding would occur at least 50 feet or more from streams. The minimum distance would vary according to susceptibility to impacts from erosion. For example, relatively level farm ground with minimal riparian vegetation poses a minimal risk that stockpiled material would erode into a stream during the summer construction season. Therefore, stockpiling may take place 50 feet of a stream. However, sensitive salmonid streams on steeper terrain pose a different set of risks and would require a setback of 150 feet from a perennial stream. Through negotiations during prefiling, Oregon LNG and agencies agreed to a minimum 150-foot setback for ATWS in the Coast Range or where greater riparian protection is needed in farmlands. Locating ATWS 150 feet from streams would minimize impacts to habitat utilized by riparian species. The width of clearing would be reduced by aligning the Pipeline parallel to existing cleared easements, such as transmission lines, roads, and railroads. Approximately 1.4 miles of new temporary access roads would be constructed. There would be an access point to the Pipeline approximately every mile. Extensive use of existing logging roads in the Coast Range minimizes impacts to bird habitat. Pipeline storage yards would be located in developed areas and not require impacts to migratory bird habitat.

Within the 50-foot-wide permanent easement, FERC typically allows 10 feet centered over pipelines to be mowed on an annual basis. While this may occur, Oregon LNG does not contemplate mowing on an annual basis. Thus, compensatory mitigation would be proposed even though the actual impact is likely to be less severe than that allowed by FERC. FERC allows woody vegetation to be maintained at a height of 15 feet over a 30-foot wide strip over the Pipeline. Oregon LNG is committed to planting trees and shrubs up to the 10-foot-wide herbaceous strip over the Pipeline in forested wetlands and riparian areas. Oregon LNG has committed to not topping trees and shrubs at 15 feet within 15 feet of the Pipeline in forested wetlands and riparian areas. Oregon LNG may prune branches up to a maximum height of 10 feet on the Pipeline side of the 10-foot-wide herbaceous strip. Otherwise, canopies would be managed to allow for full canopy closure in forested wetlands and riparian areas. The remaining permanent easement, TWS, and ATWS would be restored on a trajectory to reestablish preconstruction habitat conditions.

Revegetation would occur immediately after construction has been completed. Native tree and shrub species would be established outside the 10-foot-wide maintenance corridor centered over the pipe.

10.1.1 Preconstruction Monitoring

Oregon LNG first completed 2 years of protocol level surveys for the northern spotted owl and marbled murrelet in August 2009 followed by the completion of one additional year of spotted owl surveys in 2012 and an additional 2 years of protocol marbled murrelets surveys in July 2013. Oregon LNG’s survey data, combined with data from private and public landowners, indicates that there are no nesting pairs of either species within the surveyed portions of the construction corridor or within an area subject to noise disturbance during construction. However, due to access restrictions, protocol spotted owl surveys could not be completed in 2013 and two areas of potentially suitable marbled murrelet habitat could not be surveyed in 2012 and 2013. Oregon LNG is committed to additional surveys, if the Pipeline construction schedule is delayed and to protocol surveys in areas that were previously unsurveyed.

Assuming that vegetation clearing cannot be avoided during the nesting and breeding season, Oregon LNG would provide biologists to conduct a preconstruction reconnaissance of the Terminal and Pipeline corridor to identify any active migratory bird nests. If one or more active nests are identified within the construction corridor, biologists would mark the location(s) of the nest(s) in the field and on the construction plans and delay vegetation clearing around the active nest(s) until such time as the nest(s) have fledged or failed (due to natural causes). If one or more active nests are identified outside the construction corridor but nearby, the biologists would monitor the nest(s) during construction for signs of disturbance. If it appears that the monitored nest(s) are exhibiting disturbance that could lead to unintentional indirect take pursuant to the MBTA, construction should be halted temporarily until such time as the nest has fledged or failed (due to natural causes). Trees with nests may be cut during the non-nesting season.

In the absence of field surveys, no harvest of trees in riparian areas would occur until migratory bird species have completed nesting activities, after August 15 and before April 15. Vegetation clearing shall not occur within 500 feet of any existing eagle or peregrine falcon nest locations or trees used as perches by eagles and falcons unless a variance is granted, in writing, by USFWS. Band-tailed pigeon nesting or roosting tree(s), as well as any tree(s) near an existing great blue heron rookery, are not to be removed unless approved in writing by USFWS. Removing trees in a designated nest patch of a northern spotted owl shall be avoided. Removing trees in a cluster of trees known to provide nesting for marbled murrelets shall be avoided.

Unintentional take, the observation that land clearing has unintentionally killed a migratory bird, shall be reported to Oregon LNG's designated environmental compliance officer within 24 hours of such an incident. The environmental compliance officer would be responsible for reporting the unintentional take to USFWS.

10.2 Compensatory Mitigation

Oregon LNG is committed to complying with ODFW's Habitat Mitigation Policy. Compensatory mitigation would be provided for impacts to terrestrial habitats, riparian areas. In addition, compensatory mitigation would be provided for permanent impacts to wetlands in compliance with state and federal wetland rules. Key elements of the habitat mitigation plan include provisions to support habitats that support the special-status species listed in Table 10-1. Oregon LNG is committed to supporting the preservation, restoration, and enhancement of upland and wetland prairie habitat that would support yellow-breasted chat, Oregon vesper sparrow, streaked horned lark, and other raptors. Compensatory mitigation would be provided to preserve, restore, and enhance riparian habitat in support of bald eagle, great blue heron, little wouldow flycatcher, purple martin, yellow-breasted chat, osprey, acorn woodpecker, and other raptors. For habitat impacts in the Coast Range, Oregon LNG is proposing to place conservation easements on large-blocks of land and manage them to create late-successional and old-growth habitat suitable for interior forest species such as olive sided flycatcher, other raptors, and for northern spotted owls and marbled murrelets. The habitat mitigation plan would be provided as an appendix to a Memorandum of Understanding established between Oregon LNG and the USFWS.

10.3 Operational Mitigation, Post-Construction Monitoring, and Adaptive Management

10.3.1 Construction Monitoring

If one or more active nests are identified outside of the construction corridor but nearby, then a qualified biologist would monitor the nest(s) during construction for signs of disturbance. If it appears that the monitored nest(s) are exhibiting disturbance that could lead to unintentional indirect take pursuant to the MBTA, the environmental compliance inspector would immediately contact the USFWS to discuss potential actions. Potential actions may include a determination of no significant effect, a temporary work stoppage until nesting is completed, measures to muffle noise or vehicle traffic, or other measures to reduce disturbance.

10.3.2 Contingency Salvage

In the event that chicks or fledglings are found out of a nest during construction then the following actions would be taken. The USFWS would be contacted immediately during normal business hours. If eggs or chicks can be salvaged, then they would be taken to a wildlife rehabilitation center (such as the Portland Audubon Society) by a person authorized to handle migratory birds. The EI shall maintain a log of unintentional bird mortalities and file a report to the USFWS within 24 hours of an occurrence.

SECTION 11

Reptiles and Amphibians

Section 5.0 in the Applicant-Draft BA and Appendix 3D in Resource Report 3 (Oregon LNG, 2013) document Project effects on reptiles and amphibians. Federally threatened, endangered, and candidate amphibian and reptile species are *not* documented to occur within the Pipeline construction corridor or Project area. Preconstruction surveys and a search of the ORNHIC database of recorded sightings revealed that there have been no documented occurrences of federally threatened, endangered, and candidate reptile species in the Project area, nor is there any federal or state designated critical habitat. Hence, species-specific conservation measures are not recommended.

Mitigation strategies recommended for aquatic, riparian, wetland, and upland habitats should minimize impacts to their habitat. Compensatory measures to acquire conservation easements for Coast Range riparian and upland habitats should in effect offset adverse effects on reptiles and amphibians.

Biologists would be deployed to riparian areas immediately before land-clearing to search for and salvage amphibians and reptiles according to a plan approved by ODFW. Biologists would obtain state and federal collection and handling and salvage permits before Project construction. If riparian land clearing is not concurrent with Pipeline construction, then biologists would be deployed again immediately before construction to search for and salvage reptiles and amphibians. No in-stream work is anticipated during land-clearing. Thus, amphibian and reptile salvage need not focus in streams during the land-clearing phase. In-stream reptile and amphibian salvage would occur concurrently with the conduct of fish salvage before Pipeline construction. The reptile and amphibian salvage plan would be prepared concurrently with final engineering design.

SECTION 12

Invertebrates

Mitigation measures for invertebrates are based on findings documented in Section 5.4 of the Applicant-Draft BA. Section 5.5 addresses rare plants, several of which are considered host species for butterflies.

12.1 Onsite Mitigation

12.1.1 Fender's Blue Butterfly (*Icaricia icarioides fenderi*) (Federal Endangered)

Fender's blue butterfly (FBB) is not known to occur within 2 miles of the proposed construction corridor. The nearest occurrence of suitable habitat within the action area is likely to be where this species' dominant host plant, Kincaid's lupine, has been documented to occur. Kincaid's lupine was not observed within the portions of the Pipeline corridor surveyed in 2008 (see Applicant-Draft BA Appendix 14).

Therefore, the Project may affect, but is not likely to adversely affect FBB. There would not be any effects on designated critical habitat. The following conservation measures are proposed to avoid or minimize effects on FBB:

- Survey areas of potentially suitable habitat on
- Properties where access was denied before construction. Target species are FBB, host species in the genus *Lupinus,* and nectar plants as listed in the draft joint recovery plan (USFWS, 2008b).
- Limit removal of host or nectar plants to the minimum necessary for construction.
- Restore areas that are cleared to preconstruction condition. Seed mixes and plantings in hedgerows, roadsides, or other nonagricultural areas would include nectar plants for FBB.
- If larval host plants are identified during construction, consider the following avoidance and mitigation measures:
  - Implement micrositing: alter the Pipeline route slightly to avoid effects on plants.
  - Remove and conserve plants; replant following construction. However, current research has found that replanted adult plants have a low survival rate. Plants should either be relocated immediately or stored for later planting. Transplanting of adult plants during the growing season is not advised. Disturbance during late fall/winter, when plants are dormant, lowers effects on plants. Disturbing plants during winter may result in plants that do not thrive as well during the following growing season.
  - Mitigate by seeding an approved offsite area with the same species. Propagation from seed is more successful than transplanting of adult plants.
  - Obtain agency approval of mitigation, as well as monitoring for a defined period of time.

12.1.2 Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*) (Federal Threatened)

Because typical suitable habitat for the larval host plant is not found at the Terminal or along the Pipeline construction right- of-way, and neither the Oregon silverspot butterfly nor its larval host plant has been documented within 2 miles of the proposed action even though dispersal habitat may be present, the Project may but is not likely to adversely affect the Oregon silverspot butterfly. No designated critical habitat occurs within the Project area. The nearest documented occurrence of the species is located approximately 5 miles south of the Terminal in the Clatsop Plains area (ORNHIC, 2009).

The following conservation measures are proposed to avoid or minimize effects on the Oregon silverspot butterfly:

- Survey areas of potentially suitable habitat on properties where access was denied before construction. Target species are Oregon silverspot butterfly, associated larval host species, and nectar plants as listed above.
- Limit removal of host or nectar plants to the minimum necessary for construction.
- Restore cleared areas to preconstruction condition.
- If larval host plants are identified during construction, consider the following avoidance and mitigation measures:
  - Implement micrositing: the Pipeline route would be altered slightly to avoid effects on plants.
  - Remove and conserve plants; replant following construction.

12.1.3 Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*) (Federal Candidate)

Because no suitable habitat is present within the action area and neither this butterfly nor its larval host plant has been documented within the Project area, the proposed action may affect, but is not likely to adversely affect Taylor's checkerspot butterfly. Critical habitat has not been designated for the species.

The following conservation measures are proposed to avoid or minimize effects on Taylor's checkerspot butterfly:

- Survey areas of potentially suitable habitat on properties where access was denied before construction. Target species are Taylor's checkerspot butterfly, associated larval host species, and nectar plants as listed above.
- Limit removal of host or nectar plants to the minimum necessary for construction.
- Restore cleared areas to preconstruction condition.
- If larval host plants are identified during construction, consider the following avoidance and mitigation measures:
  - Implement micrositing: the Pipeline route would be altered slightly to avoid effects on plants.
  - Remove and conserve plants; replant following construction.

12.2 Compensatory Mitigation

FBB is associated with its primary host plants, *Lupinus sulphureus* ssp. *kincaidii*, *L. arbustus* (longspur lupine), and *L. albicaulis* (sickle-keeled lupine). The majority of adult foraging behavior occurs within 1 kilometer (km) of a host plant. Adult nectar sources are typically species that are not listed as threatened or endangered, such as: *Allium acuminatum* (tapertip onion), *Allium amplectens* (narrow-leaved onion), *Calochortus tolmiei*, *Camassia quamash*, *Cryptantha intermedia* (clearwater cryptantha), *Eriophyllum lanatum*, *Geranium oreganum* (Oregon geranium), *Iris tenax* (Oregon iris), *Linum angustifolium* (pale flax), *Linum perenne* (blue flax), *Sidalcea campestris* (meadow checker-mallow), *Sidalcea malviflora* ssp. virgata, *Vicia cracca* (bird vetch), *V. sativa* (common vetch) and *V. hirsute* (tiny vetch) (USFWS, 2008b).

For the purposes of modeling potential direct and indirect take the USFWS recommended several steps to evaluate potential presence and habitat of FBB. Oregon LNG is committed to following the USFWS's recommendations.

1) Map potential suitable habitat (this step was completed for Oregon LNG by USFWS).
   a. Identify potential suitable habitat as high (Level 1), medium (Level 2) or low (Level 3)
      i. High-Oak savannah; remnant upland or wet prairie; abandoned pastures or fields (e.g., abandoned ryegrass field)
      ii. Medium-degraded wet prairies, fields, and pastures that are not plowed or infrequently plowed

   iii. Low-Roadside ditches, fence rows, edges between fields and forest that are typically not cultivated, but often treated with herbicides

   b. Buffer each Level 1 habitat by 1 km

2) Determine if there is any Level 3 habitat within the 1 km buffer of each Level 1 polygon

   a. Determine the number of Level 3 polygons

   b. Determine the number of acres of Level 3 habitat are present

Compensatory mitigation for FBB is associated with habitat rare plant mitigation as described in Section 6.2.2.

12.3 Operational Mitigation and Post-Construction Monitoring

Invertebrates of concern are closely associated specific habitats and host plants. Operational mitigation, construction monitoring, and adaptive management for invertebrates is covered in Section 6.3.

SECTION 13

Other Birds

Mitigation measures for other birds are based on findings documented in Section 5.3 of the Applicant-Draft BA.

13.1 Onsite Mitigation

13.1.1 Streaked Horned Lark (*Eremophila alpestris strigata*) (Federal Threatened, State Sensitive)

Potentially suitable habitat for the streaked horned lark is present in the Project area. Disturbance attributable to the proposed action has the potential to disturb this ground-nesting bird. No effects are expected on their populations.

The following conservation measures are incorporated as part of the proposed action to minimize effects on streaked horned lark potentially suitable habitat:

- Preconstruction clearance surveys would be conducted in areas of potential suitable habitat for streaked horn larks along the Pipeline between MP 82.7 and MP 86.8 if construction is planned to occur during the nesting season (March to July).
- If nests are located in the construction area, postpone or reschedule construction until the completion or natural failure of nesting and fledging.
- If streaked horned larks are confirmed in the Project area during construction, a speed limit of 15 mph would be maintained in areas of known or assumed horned lark occupied habitat to avoid flushing birds into oncoming traffic.
- If streaked horned larks are confirmed in the Project area during construction, areas of affected native habitats would be mapped and restored with an ODFW-approved native seed mix.

Standard nest survey methods would be used to survey suitable habitat within the disturbance areas for the potential presence of nesting streaked horned larks. Experienced biologists would conduct the preconstruction clearance nest surveys by walking 75-foot-wide transects while sweeping the survey area with binoculars for the presence of ground nests associated with the species. If an active nest is identified within the disturbance area during preconstruction clearance surveys of suitable habitats (described above), Oregon LNG would take one of the following actions: (1) install and maintain an avoidance buffer (defined through consultation with USFWS) until the young have fledged or the nesting season ends; (2) modify the Pipeline route (if practicable); or (3) provide compensatory mitigation in the form of land acquisition.

13.1.2 Western Yellow-billed Cuckoo (*Coccyzus americanus*) (Federal Threatened)

No riparian cottonwood trees would be removed from the small patches of cottonwood riparian habitat along the Pipeline corridor. A few cottonwoods may be removed from mixed deciduous stands within the action area, but these areas are not considered suitable habitat for the western yellow-billed cuckoo. Therefore, no habitat loss is expected as a result of the proposed action.

Oregon LNG would implement the following conservation measures to avoid or minimize effects on western yellow-billed cuckoos:

- Preconstruction clearance surveys would be conducted on the west and east banks of the Columbia River where the Pipeline crosses the only portion of the action area considered marginally suitable for yellow-billed cuckoo nesting habitat.
- If any protected species are observed during preconstruction clearance surveys, the results would be submitted to USFWS prior to initiation of construction.

13.2 Effects and Compensatory Mitigation

No permanent effects on suitable or critical habitat are anticipated. These two species are not expected to be adversely affected nor require compensatory mitigation.

If future preconstruction clearance surveys result in a streaked horned lark detection within 325 feet of the Pipeline, Oregon LNG would immediately notify and consult with USFWS to identify measures necessary to prevent “take” or “harassment.” Possible measures include construction deferment, habitat replacement via land acquisition, or route changes (as practicable).

SECTION 14
Mammals

Section 5.2.1 in the Applicant-Draft BA provides the basis for mitigation measures recommended for the Columbian White-tailed Deer. Columbian white-tailed deer may be directly affected by temporary habitat loss during construction of the Pipeline. This effect would be temporary and of short duration. In addition, habitat would not likely be affected in any significant way because the species' habitat in the Pipeline corridor near the species' current range is limited and of low quality relative to the quality of the surrounding habitat, affected habitat (i.e., primarily agricultural fields) would be returned to preconstruction conditions, and only a small amount of potentially suitable habitat would be affected.

14.1 Onsite Mitigation

14.1.1 Columbia White Tailed Deer (*Odocoileus virginianus leucurus*) (Endangered)

Oregon LNG would implement the following conservation measures to avoid or minimize effects on Columbian white-tailed deer:

- Preconstruction surveys would be conducted in suitable habitat within the action area to identify any Columbian white-tailed deer or signs of the subspecies in the vicinity of the Project.
- Project personnel would be trained in the identification of Columbian white-tailed deer and instructed to reduce vehicle speeds to 15 mph around the Project site in areas of potentially suitable habitat (MP 81.5 to MP 84.4) to avoid vehicle-deer collisions. Project personnel would also be instructed not to approach adults or fawns at any time.
- If Columbian white-tailed deer are observed within the action area during preconstruction surveys or during construction, Oregon LNG would work with USFWS and ODFW to identify appropriate mitigation. For example, construction and restoration activities generating noise and visual activity above local ambient noise and visual activity levels in areas that support Columbian white-tailed deer (MP 82.7 to MP 84.4) may be avoided during the fawning season from 1 June to 15 July.
- The permanent ROW and temporarily affected areas would be revegetated with native species that would create suitable habitat for Columbian white-tailed deer browsing.

14.2 Effects and Compensatory Mitigation

Columbian white-tailed deer are not known to occur in the action area and potentially suitable habitat in the action area is very limited and of relatively low quality compared to the general vicinity. However, there is a low likelihood that the species could occur in the area during construction, which could result in adverse effects such as disturbance of fawning or does or abandonment and predation of fawns. Therefore, a ***may affect, not likely to adversely affect*** determination is warranted for Columbian white-tailed deer.

Because no critical habitat has been designated for the species, the proposed action would have ***no effect*** on designated critical habitat for this species.

SECTION 15
References

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Tables

TABLE 1-1
Oregon Department of Fish and Wildlife Mitigation Goals and Implementation Standards by Habitat Category

Habitat Category	Mitigation Goal	Achieved by
Category 1	No loss of habitat quantity or quality	Avoidance
Category 2	No net loss of habitat quantity or quality and to provide a net benefit of habitat quantity or quality	In-kind, in-proximity mitigation
Category 3	No net loss of habitat quantity or quality	In-kind, in-proximity mitigation
Category 4	No net loss of habitat quantity or quality	In-kind or out-of-kind, in-proximity or off-proximity mitigation
Category 5	Net benefit in habitat quantity and quality	Actions that improve habitat conditions
Category 6	Minimize impacts	Conscientious Project design

Source: Oregon Department of Fish and Wildlife (ODFW). 2006. The Oregon Conservation Strategy. Oregon Department of Fish and Wildlife, Salem, Oregon. February.

TABLE 3-1
Definitions of Categories of Relative Intensity for Habitat Removal and Other Indirect Effects for the Northern Spotted Owl

Habitat Category	Definition
Severe	Removal of a Site/Activity Center, or otherwise cause a northern spotted owl home range to become nonfunctional (loss of the home range)
High	Removal of any High NRF acres from any portion of the home range, or Project corridor bisects the home range and impacts the Core Area (passes within 0.5 mile of the Site/Activity Center), or removal of > 5 acres total of NRF from any portion of the home range, or removal of > 2 acres total of NRF within the Core Area
Moderate	Project corridor bisects the home range and does not impact the Core Area (passes within 0.5 mile of the Site/Activity Center), or removal of 2-5 acres total of NRF from any portion of the home range, or removal of < 2 acres total of NRF within the Core Area
Low	Project corridor touches the home range boundary, but does not bisect it, or removal of < 2 acres total of NRF within a home range (all outside of the Core Area), or the Habitat is located outside of a northern spotted owl home range

TABLE 3-2
Impacts and Proposed Mitigation for Habitat Removal

Impact Category	Habitat Impacts (acres)	Habitat Type	Mitigation Ratio	Unadjusted Mitigation (acres)	Adjustment Factor	Adjusted Mitigation (acres)
High	24	NRF	4.00	98	1.00	98
	18	DISP	2.50	44	1.00	44
	1	CAP	2.00	2	1.00	2
Mod	7	NRF	3.00	21	1.00	21
	0	DISP	2.00	1	1.00	1
	4	CAP	1.75	7	1.00	7
Low and outside	19	NRF	3.00	58	1.00	58
	197	DISP	2.00	393	1.00	393
	0	CAP	1.50	0	1.00	0
Total	271			624		624

TABLE 3-3
Impacts and Proposed Mitigation for Other Indirect Effects

Impact Category	Habitat Impacts (acres)	Habitat Type	Mitigation Ratio	Unadjusted Mitigation (acres)	Adjustment Factor	Adjusted Mitigation (acres)
High	48.93	NRF	4.00	195.72	0.80	156.58
	27.48	Dispersal	2.50	68.70	0.35	24.05
	1.39	Capable	2.00	2.78	0.30	0.83
Mod	7.82	NRF	3.00	23.46	0.80	18.77
	0.96	Dispersal	2.00	1.92	0.23	0.44
	1.76	Capable	1.75	3.08	0.20	0.62
Low and outside	0	NRF	3.00	0	0.60	0
	449.90	Dispersal	2.00	899.80	0.13	116.97
	0	Capable	1.50	0	0.10	0
Total	538.24			1195.46		318.26

TABLE 3-4
Summary of Adjusted Habitat Acquisition (acres) for Removal and Other Indirect Effects

Habitat Type	Other Indirect Effects	Removal	Total
NRF	175.35	148.96	324.30
Dispersal	141.46	346.23	487.83
Capable	1.45	6.38	7.83
Total	318.26	501.57	819.96

TABLE 3-5
Theoretical Scaling of Habitat Acquisitions Dependent on Availability in the Marketplace

Habitat Type to Be Mitigated	Adjusted Mitigation Obligation (acres)	Multiplier (Division) for Converting to Same or Different Habitat Type	Out-of-Kind Habitat Type	Out-of-Kind Area (acres) to be Acquired
NRF	324.30	2.5	Dispersal	810.75
NRF	324.30	4.0	Capable	1,297.20
Dispersal	487.83	2.5	Capable	1,219.58
Dispersal	487.83	(2.5)	NRF	195.13
Capable	7.83	(2.5)	Dispersal	3.13
Capable	7.83	(4)	NRF	1.96

TABLE 3-6
Silvicultural Treatment Ratios for Northern Spotted Owl Habitat Removal and Other Indirect Impacts to Northern Spotted Owl

Habitat Category Impacted	HIGH Impacted Home Ranges	MODERATE Impacted Home Ranges	LOW Impacted Home Ranges and OUTSIDE Home Ranges
High NRF	N/A	N/A	N/A
NRF	N/A	N/A	N/A
Dispersal	5:1	4:1	3:1
Capable	3:1	2.5:1	2:1

N/A = not applicable

TABLE 4-1
Marbled Murrelet Suitable Habitat Units within the Action Area

Site No.	Status*	Inland Zone	Owner	NWFP Land Use Allocation
M1901	OSH	1	Private	None
M3001	OSH	1	Private	None
M3901	USH	1	ODOT	None
ALD1	USH	1	ODF	None
ALD2	USH	1	ODF	None
ALD3	USH	1	ODF	None
M4601	USH	1	ODF	None
WOLF	USH	1	ODF	None

* OSH = assumed occupied suitable habitat; USH = unoccupied suitable habitat

TABLE 4-2
Definitions of Categories of Relative Intensity for Habitat Removal and Other Indirect Effects for the Marbled Murrelet

Habitat Category	Definition
Severe	Removal of a known nest tree in OSH at any time of year, or otherwise cause a marbled murrelet SHU to become nonfunctional
High	Removal of any Suitable Habitat, or removal of Recruitment Habitat within the 300-foot buffer around the Suitable Habitat (regardless of whether SHU is in Critical Habitat or not)
Moderate	Removal of any Capable Habitat within the 300-foot buffer around the Suitable Habitat (regardless of whether SHU is in Critical Habitat or not), or removal of any Recruitment Habitat within the 0.5-mile buffer around the Suitable Habitat located within a SHU in Critical Habitat
Low	Removal of Recruitment Habitat outside of an SHU, or removal of Capable Habitat within the 0.5-mile buffer around the Suitable Habitat located within a SHU in Critical Habitat

TABLE 4-3
Removal Impacts and Habitat Acquisition for the Marbled Murrelet

Impact Category[a]	Habitat Impact (acres)	Habitat Type	Mitigation Ratio	Mitigation (acres)	Adjustment Factor	Adjusted Mitigation (acres)
High	1.77	Suitable	8.00	14.16	1.00	14.16
	12.89	Recruitment	4.00	51.56	1.00	51.56
	16.11	Capable	2.00	32.22	1.00	32.22
Mod	0.00	Suitable	N/A	N/A	1.00	0.00
	2.03	Recruitment	3.00	6.09	1.00	6.09
	5.18	Capable	1.75	9.07	1.00	9.07
Low and outside	N/A	Suitable	N/A	N/A	1.00	0.00
	54.59	Recruitment	2.50	136.48	1.00	136.48
	564.60	Capable	N/A	564.60	0.00	0.00

[a] There are no impacts in the “severe” category.

TABLE 4-4
Other Indirect Impacts and Habitat Acquisition for the Marbled Murrelet

Impact Category[a]	Habitat Impact (acres)	Habitat Type	Mitigation Ratio	Mitigation (acres)	Adjustment Factor	Adjusted Mitigation (acres)
High	5.99	Suitable	8.00	47.92	0.80	38.34
	22.26	Recruitment	4.00	89.04	0.35	31.16
	26.10	Capable	2.00	52.20	0.30	15.66
Mod	0.00	Suitable	0.00	0.00	0.80	0.00
	0.00	Recruitment	3.00	0.00	0.23	0.00
	0.00	Capable	1.75	0.00	0.20	0.00
Low and outside	N/A	Suitable	0.00		0.60	0.00
	34.60	Recruitment	2.50	86.50	0.13	11.25
	0.00	Capable	0.00	0.00	0.10	0.00

[a] There are no impacts in the "severe" category.

TABLE 4-5
Summary of Adjusted Habitat Acquisition (acres) for Removal and Other Indirect Effects

Habitat Type	Other Indirect Effects	Removal	Total
Suitable	38.34	14.16	52.50
Recruitment	42.41	194.13	236.54
Capable	15.66	41.29	56.95
Total	**96.41**	**249.58**	**345.99**

TABLE 4-6
Hypothetical Adjustments to Mitigation for Out-of-kind Habitat Acquisitions

Habitat Type to be Mitigated	Adjusted Mitigation Obligation (acres)	Multiplier (Division) for Converting to Different Habitat Type	Out-of-Kind Habitat Type	Out-of-Kind Area (acres) to be Acquired
Suitable	52.50	1.5	Recruitment	78.75
Suitable	52.50	5	Capable	262.50
Recruitment	236.54	3.5	Capable	827.89
Recruitment	236.54	(1.5)	Suitable	157.69
Capable	56.95	(3.5)	Recruitment	16.27
Capable	56.95	(4.0)	Suitable	14.06

TABLE 4-7
Mitigation Ratios for Silvicultural Treatments for Indirect Effects on Marbled Murrelet Habitat

Habitat Category Impacted	HIGH-Impacted Suitable Habitat Units	MODERATE Impacted Suitable Habitat Units	LOW Impacted Suitable Habitat Units and OUTSIDE Suitable Habitat Units
Recruitment	N/A	N/A	4:11
Capable	5:1	4:1	3:1

TABLE 5-1
Rivers and Streams Crossed Using HDD

Pipeline Milepost	River or Stream Crossed	Length (feet)	Milepost Begin	Milepost End
Columbia River and Estuaries				
Terminal	Skipanon River	1,950	NA	NA
0.4	Levee/Columbia River[a]	1,450	0.3	0.6
1.0	Adair Slough	1,480	0.9	1.2
3.0	Lewis and Clark River	2,950	2.8	3.4
5.2	Lewis and Clark River	2,450	5.0	5.5
5.0	*Unnamed Waterway*	*Included in HDD listed above*		
5.2	*Tributary of Lewis and Clark River*	*Included in HDD listed above*		
5.4	*Tributary of Lewis and Clark River*	*Included in HDD listed above*		
5.7	Lewis and Clark River	2,100	5.6	6.0
5.8	*Tributary of Lewis and Clark River*	*Included in HDD listed above*		
11	Lewis and Clark River	1,320	10.9	11.2
Northern Oregon Coastal Basin Rivers				
33.5	Nehalem River	2,010	33.3	33.7
41.0	Rock Creek	1,910	40.9	41.3
43.1	South Fork Rock Creek	2,920	43.1	43.6
43.4	*Bear Creek*	*Included in HDD listed above*		
43.5	Tributary of Bear Creek			
57.7	Rock Creek	3,000	57.5	58.1
57.7	*Tributary of Rock Creek*	*Included in HDD listed above*		
57.7	*Braided Channel to Rock Creek*	*Included in HDD listed above*		
63.8	Nehalem River	3,370	63.6	64.3
Columbia Basin				
82.3	Columbia River	5,030	81.9	82.8
82.0	*Dyna Nobel Channel*	*Included in HDD listed above*		

[a] Horizontal directional drill (HDD) is tangential to the Columbia River in this location and the HDD is proposed to minimize impacts to an existing levee and tidal wetlands.

TABLE 5-2
Potential Direct Take of Special-Status Species from Ballast/Cooling Water Withdrawal, Pile-Driving Noise, and Fish Salvage

Species	Annual Take of Juveniles Resulting from Ballast Water Withdrawal	Take Resulting from Pile-Driving Noise	Take of Juveniles Resulting from Fish Salvage
Endangered Species			
Upper Columbia River Steelhead Trout (*O. mykiss*)	0	0	0
Snake River Sockeye Salmon (*O. nerka*)	0	0	0
Upper Columbia River Spring-run Chinook Salmon (*O. tshawytscha*)	0	0	0
Threatened species			
Lower Columbia River Steelhead Trout (*O mykiss*)	0	Harassment of adults	0
Middle Columbia River Steelhead Trout (*O. mykiss*)	0	Harassment of adults	0
Upper Willamette River Steelhead Trout (*O. mykiss*)	0	Harassment of adults	0
Snake River Basin Steelhead Trout (*O. mykiss*)	0	0	0
Lower Columbia River Chinook Salmon (*O. tshawytscha*)	3.62	122	0
Upper Willamette River Chinook Salmon (*O. tshawytscha*)	0.04	0	0
Snake River Fall Chinook Salmon (*O. tshawytscha*)	0.15	3	0
Snake River Spring/Summer-run Chinook Salmon (*O. tshawytscha*)	0.01	0	0
Lower Columbia River Coho Salmon (*O. kisutch*)	0.22	Harassment of adults	58
Oregon Coast Coho Salmon (*O. kisutch*)	0	0	178
North American Green Sturgeon (*A. medirostris*)	0	0	0
Columbia River Chum Salmon (*O. keta*)	0	Harassment of adults and juveniles	0
Eulachon (*T. pacificus*)	Several thousand larvae (up to 0.005% of the estuarine population)	0	0

TABLE 5-3
Degree to which Species are Affected by Unquantified Sources of Take

Species	Terminal					Pipeline					
	Artificial Light and Shading	Food Web Effects	Dredge Entrainment	Turbidity (dredging and disposal)	Habitat Loss/ Alteration	Fish Salvage	Passage Impediments	Habitat Loss/ Alteration	Turbidity	Food Web Effects	Loss of Riparian Veg.
Endangered Species											
Upper Columbia River Steelhead Trout (*O. mykiss*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Snake River Sockeye Salmon (*O. nerka*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upper Columbia River Spring-run Chinook Salmon (*O. tshawytscha*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Threatened Species											
Lower Columbia River Steelhead Trout (*O. mykiss*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Middle Columbia River Steelhead Trout (*O. mykiss*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upper Willamette River Steelhead Trout (*O. mykiss*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Snake River Basin Steelhead Trout (*O. mykiss*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lower Columbia River Chinook Salmon (*O. tshawytscha*)	3	3	3	3	3	NA	NA	NA	NA	NA	NA
Upper Willamette River Chinook Salmon (*O. tshawytscha*)	2	1	1	1	1	NA	NA	NA	NA	NA	NA
Snake River Fall Chinook Salmon (*O. tshawytscha*)	1	2	1	1	1	NA	NA	NA	NA	NA	NA
Snake River Spring/Summer-run Chinook Salmon (*O. tshawytscha*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lower Columbia River Coho Salmon (*O. kisutch*)	1	2	NA	NA	NA	2	2	2	2	2	2
Oregon Coast Coho Salmon (*O. kisutch*)	NA	NA	NA	NA	NA	3	3	3	3	3	3
North American Green Sturgeon (*A. medirostris*)	NA	1	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Degree to which Species are Affected by Unquantified Sources of Take

Species	Terminal					Pipeline					
	Artificial Light and Shading	Food Web Effects	Dredge Entrainment	Turbidity (dredging and disposal)	Habitat Loss/ Alteration	Fish Salvage	Passage Impediments	Habitat Loss/ Alteration	Turbidity	Food Web Effects	Loss of Riparian Veg.
Columbia River Chum Salmon (*O. keta*)	2	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Eulachon (*T. pacificus*)	NA	NA	1	1	NA	NA	NA	NA	NA	NA	NA

Notes:

NA = Not applicable.

1 = Low effect.

2 = Moderate effect.

3 = High effect.

TABLE 5-4
Duration of Project Impacts

Impact	Duration	Notes
Ballast and Cooling Water Entrainment	Life of the Project	Number of entrained fish estimated to be low.
Pile-Driving Noise	One in-water work period	One-time effect, salmonid numbers low during in water work window.
Dredging Entrainment	Initial one-time effect, periodic maintenance dredging at approximately 3-year intervals	Salmonid numbers low during in-water work window; salmonids and other special-status species not especially susceptible.
Fish Salvage	One-time effect during Pipeline construction	Approximately 236 listed fish (Lower Columbia River and Oregon Coast coho) will be harassed and approximately seven fish will suffer mortality during the removal process.
Habitat Loss/Alteration	Months to years	Terminal habitat alteration of minor concern. Habitats will be returned to preconstruction conditions.
Loss of Riparian Vegetation	Years to life of the Project	Loss of riparian vegetation will be significant only at a subset of crossings.

TABLE 5-5
Proposed Mitigation by Evolutionarily Significant Unit

Species	Present During In-water Work	Use of Terminal Action Area, Pipeline Action Area, or Both	Number of non-HDD Pipeline Crossings	Total Estimated Take (lethal and nonlethal)	Proposed Mitigation
Endangered Species					
Upper Columbia River Steelhead Trout (*O. mykiss*)	No	Terminal	NA	0	None
Snake River Sockeye Salmon (*O. nerka*)	No	Terminal	NA	0	None
Upper Columbia River Spring-run Chinook Salmon (*O. tshawytscha*)	No	Terminal	NA	0	None
Threatened Species					
Lower Columbia River Steelhead Trout (*O. mykiss*)	Yes (few adults)	Terminal	NA	0	None
Middle Columbia River Steelhead Trout (*O. mykiss*)	Yes (few adults)	Terminal	NA	0	None
Upper Willamette River Steelhead Trout (*O. mykiss*)	Yes (few adults)	Both	N/A	0	None
Snake River Basin Steelhead Trout (*O. mykiss*)	No	Terminal	NA	0	None
Lower Columbia River Chinook Salmon (*O. tshawytscha*)	Yes (juveniles)	Both	0	3.62 – 13.81 (annually), and 122 (one-time pile-driving loss)	Hess Property
Upper Willamette River Chinook Salmon (*O. tshawytscha*)	Yes (few juveniles)	Both	0	0	None
Snake River Fall Chinook Salmon (*O. tshawytscha*)	Yes (few juveniles)	Terminal	NA	0.15 – 0.56 (annually), and 3 (one-time pile-driving loss)	Hess Property mitigation site, riparian conservation easements, and culvert replacement
Snake River Spring/Summer-run Chinook Salmon (*O. tshawytscha*)	No	Terminal	NA	0.01 to 0.07 annually	None
Lower Columbia River Coho Salmon (*O. kisutch*)	Yes (few adults)	Both	9	0.22 – 1.19 (annually), and 2 (one-time salvage loss), with 58 harassed by fish salvage	Hess Property mitigation site, culvert replacements
Oregon Coast Coho Salmon (*O. kisutch*)	Yes (juveniles)	Pipeline	5	5 (one-time salvage loss), with 178 harassed by fish salvage	Hess Property mitigation site, riparian conservation easements, and culvert replacement
North American Green Sturgeon (*A. medirostris*)	No	Terminal	NA	0	None

TABLE 5-5
Proposed Mitigation by Evolutionarily Significant Unit

Species	Present During In-water Work	Use of Terminal Action Area, Pipeline Action Area, or Both	Number of non-HDD Pipeline Crossings	Total Estimated Take (lethal and nonlethal)	Proposed Mitigation
Columbia River Chum Salmon (*O. keta*)	Yes (juveniles and few adults)	Terminal	NA	0	None
Eulachon (*T. pacificus*)	No	Terminal	NA	Several thousand larvae annually	None

HDD = horizontal directional drilling

NA = not applicable

TABLE 5-6
Estimated Lower Columbia River Coho Affected by Salvage

Stream	Width (ft.)	Area (ft^2), Assuming 60 ft. of Salvage Area	% Pool	Area (m^2)	Assumed Density	Oregon Coast Coho Potentially Affected
Barret Slougha	12	720	0%	66.888	0.09	3.0
Heckarda Creek	10	600	60%	55.74	0.09	4.0
Clatskanie Riverb	18.5	1110	100%	103.119	0.19	19.6
Little Clatskanie River	2	120	0%	11.148	0.01	0.1
Merrill Creeka,b	10	600	100%	55.74	0.09	5.0
Tributary to Merrill Creekb	1	60	100%	5.574	0.06	0.3
Milton Creek	10	600	5%	55.74	0.17	5.0
Milton Creekb	22	1320	100%	122.628	0.17	20.8

[a] Not surveyed by Oregon Department of Fish and Wildlife, and thus the average coho density from all streams in all years surveyed (0.37 fish/m^2) was used.

[b] Not surveyed by Applicant, and thus are assumed to be 100 percent pool.

ft = foot/feet

ft^2 = square foot

m^2 = metric foot

TABLE 5-7
Estimated Oregon Coast Coho Affected by Salvage

Stream	Width (ft.)	Area (ft^2), Assuming 60 ft. of Salvage Area	% Pool	Area (m^2)	Assumed Density	Oregon Coast Coho Potentially Affected
Alder Creek	13	780	100%	72.462	0.28	20.3
Rock Creek	20	1200	0%	111.48	0.3	16.7
South Fork Rock Creek[a]	15	900	100%	83.61	0.37	30.9
North Fork Wolf Creeka,[b]	30	1800	100%	167.22	0.37	61.9
Clear Creek	10	600	15%	55.74	0.23	7.4

[a] Not surveyed by the Oregon Department of Fish and Wildlife, and thus the average coho density from all streams in all years surveyed (0.37 fish/m^2) was used.

[b] Not surveyed by the Applicant, and thus are assumed to be 100 percent pool.

ft = foot/feet

ft^2 = square foot

m^2 = metric foot

TABLE 5-8
Fish Barrier Projects Ranked as High Priority in Clatsop[a] , Columbia[a] ,and Wallowa Counties[b]

Basin	Subbasin	Stream	Culvert			Stream Mile	Habitat Quality	Comment
			Length	Diam.	Drop			
Columbia R	Blind Sl	Anderson Cr	60	48	0	2.5	Fair	Two pipes, both very rusty; meet fish passage standards.
Pacific Ocean	Necanicum R	Bergsvik Cr	120	72	48	0.5	Good	Water falls 4' onto fill. Culvert bows in middle. Impassable culvert.
Columbia R	Gnat Cr	Big Noise Cr	98	96	8	3.2	Good	Culvert is a velocity barrier to all fish at low flows. May be passable at higher flows in some instances.
Pacific Ocean	Necanicum R	Circle Cr	130	72	6	2.1	Good	Steel pipe inside concrete box. Many baffles in pipe. Juvenile barrier at low water. Velocity problems at high water
Pacific Ocean	Necanicum R	Circle Cr	230	72		1.6	Good	No pool below, water falls onto fill. Velocity is high.
Columbia R	Youngs R	Crosel Cr	65	48	0	1.3	Poor	Upstream of pipe is unused pasture.
Necanicum R	Bergsvik Cr	Joe Cr	54	96	12	2.1	Fair	Culvert is a low water barrier due to drop and will impede fish at high water due to slope.
Columbia R	Youngs R	Moosmoos Cr	60	36	20	1.1	Ukn	Culvert is a juvenile barrier; probably blocks adults at most flows.
Columbia R	Gnat Cr	Rock Cr	120	120	12	12.9	Good	Water cascades 12" onto bedrock. There is no pool so this culvert is impassable at most flows. Length and slope create very high-velocity water. There are several miles of fish bearing stream above this culvert.
Nehalem Bay	Nehalem R	Rock Cr	162	90	0	6.6	Good	High water velocity inhibits fish passage.
Nehalem R	N fork	Soapstone Cr	80	60	0	0.6	Fair	Could not access downstream end. Velocity of water is too high.
Columbia R	Gnat Cr	Supply Cr	40	78	12	5.4	Good	Upper end of culvert is full of rock debris leaving a 2' opening.
Klaskanine R	N fork	Un Cr	60	36	2	1	Fair	No comments.
Necanicum R	Circle Cr	Un Cr	38	0	24	0.2	Good	This culvert is located just west of ODOT culvert. Creek provides excellent habitat.
Necanicum R	Circle Cr	Un Cr	150	24	4	0.2	Good	Good habitat for cutthroat. Culvert is impassable.
Nehalem Bay	Nehalem R	Un Cr	75	60	6	0.8	Fair	High-velocity water and drop impede fish passage.
Nehalem Bay	Nehalem R	Un Cr	75	60	6	1.5	Fair	High-velocity water through culvert inhibits fish passage.
Pacific Ocean	Necanicum R	Un Cr	75	24	0	0.6	Good	0.1 mi. east of Necanicum Jct. Creek is currently dry. Culvert appears to be too small and will greatly increase water velocity.
Pacific Ocean	Necanicum R	Un Cr	0	48	0	2	Excellent	Juvenile passage is primary concern.
Rock Cr	S fork	Un Cr	163	72	0	1.4	Good	Upper 140' of pipe is steep. Bottom 40 feet 0% gradient.
Snake R	Imnaha	Imnaha	--	--	--	--	Good	Gumboot weir retrofit.
Scappoose Bay	Milton Cr	Dart Cr	80	60	16	4.5	Fair	Juvenile step barrier. Velocity impedes adult passage.

TABLE 5-8
Fish Barrier Projects Ranked as High Priority in Clatsop[a] , Columbia[a] ,and Wallowa Counties[b]

Basin	Subbasin	Stream	Culvert			Stream Mile	Habitat Quality	Comment
			Length	Diam.	Drop			
Scappoose Cr	N Scappoose CR	Alder Cr	45	60	4	0.2	Good	Middle section buckles up. Most of creek flows under culvert. Barrier.
Scappose Bay	Milton Cr	Cox Cr	60	96	0	1.6	Good	Juvenile barrier at low water, possibly velocity barrier at higher flows.
Columbia R	Clatskanie R	Merrill Cr	60	36	12	0.8	Fair	Impassable at most flows.
Columbia R	Clatskanie R	Keysone Cr	60	60	24	1	Fair	Beaver ponds above. Culvert is too small, too steep and too high. Impassable.
Nehalem Bay	Nehalem R	Un Cr	60	36	48	0.7	Fair	District Priority Rating H6—High-velocity water inhibits/prevents fish passage.
Nehalem Bay	Nehalem R	Messing Cr	38	69	0	5	Good	District Priority Rating H3—High-velocity water.
Nehalem Bay	Nehalem R	Messing Cr	72	117	0	4.3	Fair	Culvert completely rusted through with 1' metal shards sticking up throughout. Road is painted-may be slated for replacement.
Nehalem Bay	Nehalem R	E fork	65	96	2	5.4	Good	Newly placed pipe with high-velocity water due to slope of bottom 2/3 of pipe. Pipe sits on fill which extends past the end of the pipe, then there is a 1' drop to a 3' deep pool. This culvert is a fish barrier at low flows and problably impedes fish at most other flows.
Nehalem Bay	Nehalem R	Oak Ranch Cr	160	72		1.5	Good	Water velocity is high due to slope of culvert with a fair amount of silt and gravel in level sections.
Nehalem Bay	Nehalem R	Cedar Cr	50	60	0	5.6	Good	District Priority Rating H4--Not on straight-line chart. Water spills 24" onto bedrock. Couldn't assess gradient of pipe as both ends are blocked w/ debris. Creek is currently dry. Lots of gravel and intact riparian area.
Nehalem Bay	Nehalem R	Un Cr	75	36	24	1.1	Fair	Boulders have recently been placed downstream of this culvert to aid fish passage. This end may be achieved at high water but will no aid low water passage. Water velocity is high. District rank H14
Nehalem R	Beaver Cr	Un Cr	60	60	12	1	Ukn	Velocity and drop inhibit fish passage.
Nehalem R	E fork	Elk Cr	80	96	12	5.5	Fair	2 pipes. Very high-velocity water.
Nehalem R	Rock Cr	Selder Cr	40	60	0	5.4	Good	Juvenile step barrier. Velocity impedes adult passage.

[a] Source: Oregon Department of Fish and Wildlife 2006 Culvert Inventory. http://www.dfw.state.or.us/fish/passage/inventories.asp

[b] Source: Nez Perce Tribal Fisheries Program.

TABLE 6-1
Pipeline Construction Impacts by Habitat Category (Oregon)

Habitat Category	Total Acres (temporary and permanent)
1	0
2	12.61
3	267.17
4	603.00
5	166.51
6	3.27
Total	**1,052.56**

Precision loss may occur because of rounding. Area between HDD entry and exit points excluded in calculations of habitat impacts.

TABLE 6-2
Pipeline Construction Impacts by Habitat Type (Oregon)

Habitat Type	Total Acres (temporary and permanent)
AW	34.54
BP	29.96
CF	840.03
DF	65.36
E2USN	5.06
NO	16.00
PEM	26.57
PEM/PFO	0.14
PFO	12.50
PSS	11.06
PSS/PFO	6.41
ST	4.94
Total	1,052.56

Precision loss may occur because of rounding. Area between HDD entry and exit points excluded in calculations of habitat impacts.

TABLE 6-3
Ratios for Compensatory Mitigation of Coniferous Forest and Non-Oak Deciduous Forest Habitats

Habitat Category Affected	Category of Conservation Easement to be Acquired				
	Category 5	Category 4	Category 3	Category 2	Category 1
Category 5 *	NA	NA	NA	NA	NA
Category 4	2:1	2:1	2:1	2:1	2:1
Category 3	2:1	2:1	2:1	2:1	2:1
Category 2	3:1	3:1	2:1	2:1	2:1
Category 1	3:1	3:1	2:1	2:1	2:1

* Compensatory mitigation is not required for Category 5 habitat as this habitat will be restored onsite within the construction corridor and permanent easements

NA = not applicable.

TABLE 7-1
Summary of Minimization and Avoidance Measures for High-Value Wetlands

Wetland ID	4th Hydrological Unit Code (HUC) Subbasin	Milepost	High-Quality Determination	Minimization and Avoidance Measures for High-Value Wetlands
Terminal				
W4BCL05	Lower Columbia	Terminal	Greater than 5 acres in size, overall functioning score greater than 1.5	Unavoidable portion of the footprint Terminal. Bioswales moved and first-stage vaporizer moved for avoidance. Spill containment basin moved to minimize impacts.
W4BCL06	Lower Columbia	Terminal	Greater than 5 acres in size	Design of Terminal created to avoid low marsh habitats.
W4BCL07	Lower Columbia	Terminal	Greater than 5 acres in size, overall functioning score greater than 1.5	Pier modified to minimize impacts.
W5BCL084	Lower Columbia	Terminal	Palustrine Forested Wetland	Existing road used to minimize impacts.
W5BCL085	Lower Columbia	Terminal	Palustrine Forested Wetland	Existing road used to minimize impacts.
W99CL0001	Lower Columbia	Terminal	Palustrine Forested Wetland	10-inch potable water supply line with temporary impacts.
W99CL0002	Lower Columbia	Terminal	Palustrine Forested Wetland	10-inch potable water supply line with temporary impacts.
W99CL0006	Lower Columbia	Terminal	Palustrine Forested Wetland	Horizontal directional drill (HDD) staging area—unavoidable impacts.
W99CL0007	Lower Columbia	Terminal	Palustrine Forested Wetland	HDD staging area—unavoidable impacts.
W99CL0009	Lower Columbia	Terminal	Palustrine Forested Wetland	HDD staging area—unavoidable impacts.
W99CL00026	Lower Columbia	Terminal	Greater Than 5.0 Acres in size	No impacts—wetland avoided.
Pipeline				
W99CL0021	Lower Columbia	0.8	Greater than 5 acres in size	Temporary impacts unavoidable.
W40CL001	Lower Columbia	2.7	Greater than 5 acres in size	Temporary impacts unavoidable.
W40CL002	Lower Columbia	2.9	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland.
W40CL003	Lower Columbia	3.0	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and associated waterbody.
W40CL005	Lower Columbia	3.0	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and associated waterbody.
W99CL033	Lower Columbia	3.7	Palustrine Forested Wetland	Route aligned so that associated stream, wetland, and riparian area are crossed in a perpendicular orientation to minimize environmental impacts.
W99CL077A	Lower Columbia	3.7	Greater Than 5.0 Acres in size	Numerous route realignments to minimize wetland impacts. This route has the least temporary impacts associated with construction.
W5BCL042F	Lower Columbia	4.2	Greater Than 5.0 Acres in size	Numerous route realignments to minimize wetland impacts. This route has the least temporary impacts associated with construction.

TABLE 7-1
Summary of Minimization and Avoidance Measures for High-Value Wetlands

Wetland ID	4th Hydrological Unit Code (HUC) Subbasin	Milepost	High-Quality Determination	Minimization and Avoidance Measures for High-Value Wetlands
W42CL001	Lower Columbia	4.5	Greater Than 5.0 Acres in size	Additional temporary workspace aligned to avoid stream and associated riparian area.
W5BCL073	Lower Columbia	4.5	Palustrine Forested Wetland	Permanent impacts to wetland avoided through route alignment.
W40CL017	Lower Columbia	4.9	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland.
W40CL018	Lower Columbia	5.0	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland.
W39CL009	Lower Columbia	5.1	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland construction corridor necked down to 75 feet.
W1BCL001	Lower Columbia	7.9	Palustrine Forested Wetland	Wetland is crossed at narrower end to minimize impacts.
W39CL005	Lower Columbia	11.0	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland and associated waterbody.
W39CL007	Lower Columbia	11.0	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland and associated waterbody.
W39CL007	Lower Columbia	11.0	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland and associated waterbody.
W39CL012	Lower Columbia	11.0	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland and associated waterbody.
W39CL012	Lower Columbia	11.1	Palustrine Forested Wetland	HDD will be used to avoid permanent impacts to wetland and associated waterbody.
W1BCL024	Lower Columbia	12.6	Palustrine Forested Wetland	No impacts to wetland.
W1BCL038	Lower Columbia	18.5	Palustrine Forested Wetland	Route aligned to avoid impacts to wetland and parallels existing road right-of-way.
W1BCL012	Lower Columbia	18.6	Palustrine Forested Wetland	Impacts minimized by necking down construction corridor to 75 feet.
W1BCL014	Lower Columbia	18.6	Palustrine Forested Wetland	Route alignment parallels existing road and wetland extends north and south of the Project, making complete avoidance unfeasible.
W1BCL015	Lower Columbia	18.9	Palustrine Forested Wetland	Permanent impacts to wetland minimized by crossing the wetland where is narrow. Construction corridor necked down to 75 feet to minimize wetland impacts.
W1BCL016	Lower Columbia	19.0	Palustrine Forested Wetland	Additional temporary workspaces moved to avoid wetland.
W1BCL018	Lower Columbia	19.0	Palustrine Forested Wetland	Riparian wetland, unavoidable, necking down to minimize impacts.
W1BCL021	Lower Columbia	19.3	Palustrine Forested Wetland	Permanent impacts to wetland will be avoided through route alignment.

TABLE 7-1
Summary of Minimization and Avoidance Measures for High-Value Wetlands

Wetland ID	4th Hydrological Unit Code (HUC) Subbasin	Milepost	High-Quality Determination	Minimization and Avoidance Measures for High-Value Wetlands
W2BCL008	Lower Columbia	19.6	Palustrine Forested Wetland, overall functioning score greater than 1.5	Gnarly topography limits micrositing of Pipeline to avoid permanent impacts to wetland.
W7BCL006	Lower Columbia	22.4	Palustrine Forested Wetland	Permanent impacts to wetland minimized by crossing the wetland where it is narrow.
W6BCL003	Lower Columbia	22.5	Palustrine Forested Wetland, overall functioning score greater than 1.5	Permanent impacts to wetland have been minimized by crossing the wetland where it is narrow.
W3BCL101	Nehalem	36.3	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCL100	Nehalem	36.5	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCL101b	Nehalem	36.7	Palustrine Forested Wetland; Wetland Greater Than 5.0 Acres	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCL003	Nehalem	37.1	Palustrine Forested Wetland	Route alignment parallels existing road to minimize permanent impacts.
W3BCL002	Nehalem	37.2	Palustrine Forested Wetland	Route alignment parallels existing road to minimize permanent impacts.
W1BCL050A	Nehalem	39.6	Palustrine Forested Wetland, overall functioning score greater than 1.5	Route alignment parallels Highway 26 minimize impacts and wetland extends to north and south, making it unavoidable.
W8BCL007B	Nehalem	41.0	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland.
W8BCL011A	Nehalem	41.4	Palustrine Forested Wetland	Permanent impacts avoided through route alignment and temporary impacts minimized by narrowing the width of temporary workspace.
W8BCL011B	Nehalem	41.5	Palustrine Forested Wetland	Route alignment parallels Highway 26 and crosses the wetland where it is narrow to minimize permanent impacts.
W8BCL012	Nehalem	41.6	Palustrine Forested Wetland	Route aligned to parallel Highway 26 and cross wetland where it is narrow to minimize permanent impacts.
W8BCL013	Nehalem	41.7	Palustrine Forested Wetland	Route alignment parallels Highway 26 and crosses the wetland where it is narrow to minimize permanent impacts.
W8BCL018	Nehalem	42.3	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W1BCL043	Nehalem	43.2	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W1BCL044	Nehalem	43.4	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W1BTI001	Nehalem	44.2	Palustrine Forested Wetland, overall functioning score greater than 1.5	Wetland and associated stream S1BTI001 are crossed in a perpendicular orientation to minimize impacts.

TABLE 7-1
Summary of Minimization and Avoidance Measures for High-Value Wetlands

Wetland ID	4th Hydrological Unit Code (HUC) Subbasin	Milepost	High-Quality Determination	Minimization and Avoidance Measures for High-Value Wetlands
W6BCO003	Nehalem	47.6	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W6BCO004	Nehalem	47.6	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCO111	Nehalem	50.6	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCO112	Nehalem	50.8	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCO100	Nehalem	57.7	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W5BCO002	Nehalem	63.3	Palustrine Forested Wetland	Wetland avoided, no impacts.
W3BCO102	Nehalem	63.5	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCO010	Nehalem	63.7	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W6BCO005	Nehalem	69.1	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.
W3BCO007	Lower Willamette	72.9	Palustrine Forested Wetland	Unavoidable temporary impacts.
W1BCO023	Lower Willamette	73.5	Palustrine Forested Wetland	Riparian wetland, unavoidable, necking down to minimize impacts.
W5BCO010	Lower Willamette	74.5	Palustrine Forested Wetland	Wetland avoided, no impacts.
W6BCO002	Lower Willamette	74.6	Palustrine Forested Wetland	Alignment placed to avoid majority of wetland.
W6BCO001	Lower Willamette	74.9	Palustrine Forested Wetland	Riparian wetland, unavoidable, necking down to minimize impacts.
W3BCO013	Lower Columbia - Clatskanie	76.4	Palustrine Forested Wetland	Riparian wetland, unavoidable, necking down to minimize impacts.
W3BCO117	Lower Columbia - Clatskanie	79.1	Palustrine Forested Wetland	Unavoidable temporary impacts.
W5BCO013	Lower Columbia - Clatskanie	81.5	Palustrine Forested Wetland	Unavoidable temporary impacts.
W99CO003	Lower Columbia-Clatskanie	81.6	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W99CO005	Lower Columbia - Clatskanie	81.7	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.

TABLE 7-1
Summary of Minimization and Avoidance Measures for High-Value Wetlands

Wetland ID	4th Hydrological Unit Code (HUC) Subbasin	Milepost	High-Quality Determination	Minimization and Avoidance Measures for High-Value Wetlands
W99CO006	Lower Columbia - Clatskanie	81.8	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W99CO007	Lower Columbia - Clatskanie	81.8	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W99CO020	Lower Columbia-Clatskanie	81.9	Palustrine Forested Wetland	HDD will be used to avoid impacts to wetland and stream.
W99CW001	Lower Columbia - Clatskanie	82.7	Wetland Greater Than 5.0 Acres	HDD will be used to avoid impacts to wetland and stream.
W99CW002	Lower Columbia - Clatskanie	83	Palustrine Forested Wetland; Wetland Greater Than 5.0 Acres	HDD will be used to avoid impacts to wetland and stream.
W6BCW001	Lower Columbia - Clatskanie	84.2	Wetland Greater Than 5.0 Acres	Temporary impacts to agricultural wetlands.
W99CW007	Lower Columbia - Clatskanie	84.9	Palustrine Forested Wetland; Wetland Greater Than 5.0 Acres	Unavoidable wetland impacts. Wetland is located in highway medium.
W99CW005	Lower Columbia - Clatskanie	83.0 (HDD Pullback)	Palustrine Forested Wetland	Unavoidable impacts. Construction area necked down to minimize wetland impacts.

TABLE 7-2
Determination of Wetland Impacts Associated with Permanent and Temporary Easements and Planned Maintenance Activities

	75-foot Wetland Crossing Width			
	50-foot-wide Permanent Easement			25-foot-wide Construction Easement
	A	B	C	D
	Ten-foot mow strip centered over Pipeline	Additional 20-foot area (10 feet on each side of the mow strip)	Twenty-foot-wide area on outside boundary of easement (outer 10 feet of 50-foot permanent easement)	25-foot-wide additional area needed for construction; 5 feet on one side and 20 feet on the other side of the 50-foot permanent easement
Frequency of Maintenance Activities	Annual mowing	Every 3 years, routine maintenance to cut trees over 15 feet tall	No maintenance activity	No maintenance activity
Wetland type	**Type of Wetland Impact**	**Type of Wetland Impact**	**Type of Wetland Impact**	**Type of Wetland Impact**
PEM	Temporary during construction	Temporary during construction	Temporary during construction	Temporary during construction
PSS	Temporary wetland impacts during construction; permanent conversion of wetland type to PEM	Temporary	Temporary	Temporary
PFO	Temporary wetland impact during construction; permanent conversion of wetland type to PEM	Temporary wetland impact during construction; permanent conversion of wetland type to PEM or PSS	Temporary impact during construction	Temporary impact during construction

TABLE 7-3
10-Year Restoration Monitoring Schedule

Year	Monitoring and Restoration Activities			
	Season			
	Winter	Spring	Summer	Fall
1		Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Replant (As Needed)
2	Submit Results of Year 1 Monitoring	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Replant (As Needed)
3	Submit Results of Year 2 Monitoring	Monitor Sites Deficient During Year 1 and 2 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 Replant (As Needed)
4	Submit Results of Year 3 Monitoring	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Noxious Weed Control (As Needed)*	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Replant (As Needed)
5	Submit Results of Year 4 Monitoring	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Not Monitored Year 4 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Not Monitored Year 4 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 Monitor 50% of Sites Not Monitored Year 4 Replant (As Needed)
6	Submit Results of Year 5 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
7	Submit Results of Year 6 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
8	Submit Results of Year 7 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
9	Submit Results of Year 8 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
10	Submit Results of Year 9 Monitoring	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Noxious Weed Control (As Needed)
11				Submit Final Reports

*Choose sites using a stratified random approach across watersheds.

TABLE 7-4
Summary of Performance Standards

Objective	Performance Standard
Ensure that areas of wetland have hydrology through April 15	Hydrology present in accordance with U.S. Army Corps of Engineers Wetland Delineation Manual (1987)
	2 years with normal or below normal precipitation
Maintain structural diversity	Grass, shrub, and forest habitat diversity present to an extent equal or better than preconstruction conditions
Maintain species diversity	Plant a diverse assemblage of species native to the project area or region to an extent equal or better than preconstruction conditions
Ensure survivorship of trees and shrubs	Planting density within 5 percent of planting plan—typically 60 to 80 percent survivorship (native species recruitment on the site may be included)
	Increase aerial cover in successive years; 15 percent aerial cover of trees 3 years after planting; 40 to 60 percent aerial cover of shrubs after 3 years
Ensure survivorship of ground cover	30 to 50 percent ground after 1 year
	60 to 80 percent ground cover 2 years after installation in emergent zones
	50 percent ground cover within 2 years in shrub and forest habitat
	Bare substrate represents no more than 20 percent cover after 3 years
Make cover of noxious weeds and non-native species minimal	No more than 10 percent cover of invasive species such as reed canarygrass, Himalayan blackberry, Evergreen blackberry, purple loosestrife, kudzu, Japanese knotweed, thistles, and poison hemlock 3 years after installation

TABLE 8-1
In-Water Work Periods Recommended by the Oregon Department of Fish and Wildlife

Pipeline Mile	River	In-Water Work Period	
		Start Date	End Date
Terminal			
Not applicable	Columbia River Estuary[a]	November 1	February 28
Oregon Portion of the Pipeline			
Columbia Estuary Tributaries			
0 – 13.80	Youngs Bay tributaries—tidal areas[a]	July 1	September 15
13.80 – 24.25	Youngs River and tributaries	July 15	September 30
Northern Oregon Coastal Basin Rivers			
24.25 – 69.3	Upper Nehalem and tributaries	July 1	August 31
Clatskanie River			
69.3 – 71.8	Clatskanie River and tributaries	July 15	September 15
Columbia River Tributaries			
71.8 – 75.7	Columbia River tributaries (St. Helens to Sandy River)	July 15	August 31
75.7 – 81.9	Columbia River tributaries (Hunt Creek to St. Helens)	July 15	September 15
Columbia River			
81.9 – 82.5	Columbia River (Tongue Point to Bonneville Dam)	November 1	February 28
Washington Portion of the Pipeline			
Columbia River Tributaries			
82.5 – 85.9	Columbia River tributaries	TBD[b]	TBD[b]

[a] The Oregon Department of Fish and Wildlife (ODFW) normally treats the in-water work window for tidal areas as the same dates as the Columbia River Estuary. ODFW is willing to work with the applicant to approve Pipeline construction during the published in-water work window. (Stream Subgroup Meeting Notes, August 14, 2008, copy provided in Appendix 1K of Resource Report 1—General Project Description [Oregon LNG, 2013]).

[b] To be determined: Washington Department of Fish and Wildlife does not publish approved in-water periods. Oregon LNG will contact Washington Department of Fish and Wildlife to determine the preferred work period for Washington streams.

TABLE 10-1
List of Migratory Birds of Concern for the Oregon LNG Project and Associated Ecoregions within the Project Action Area

Species	Ecoregion
Harlequin Duck (*Histrionicus histrionicus)*	Coast Range
Peregrine falcon (*Falco mexicanus)*	Lower Columbia, Coast Range,
Osprey (*Pandion haliaetus)*	Lower Columbia, Coast Range
Bald Eagle (*Haliaeetus leucocephalus)*	Lower Columbia, Coast Range
Other raptors	Lower Columbia, Coast Range
Marbled Murrelet (*Brachyramphus marmoratus)*	Marine, Coast Range
Great Blue Heron (*Ardea Herodias)*	Lower Columbia, Coast Range
Band-tailed Pigeon (*Patagioenas fasciata)*	Coast Range
Northern Spotted Owl (*Strix occidentalis caurina)*	Coast Range
Rufous Hummingbird (*Selasphorus rufus)*	Lower Columbia, Coast Range
Olive-sided Flycatcher (*Contopus cooperi*)	Coast Range
Little Willow Flycatcher (*Empidonax trailii brewsteri)*	Coast Range
Streaked Horned Lark (*Eremophila alpestris strigata)*	Coast Range
Purple Martin (*Progne subis)*	Coast Range
Yellow-breasted Chat (*Icteria virens)*	Lower Columbia, Coast Range
Oregon Vesper Sparrow (*Pooecetes gramineus affinis)*	Coast Range
Acorn woodpecker (*Melanerpes formicivorus*)	Coast Range

Figures

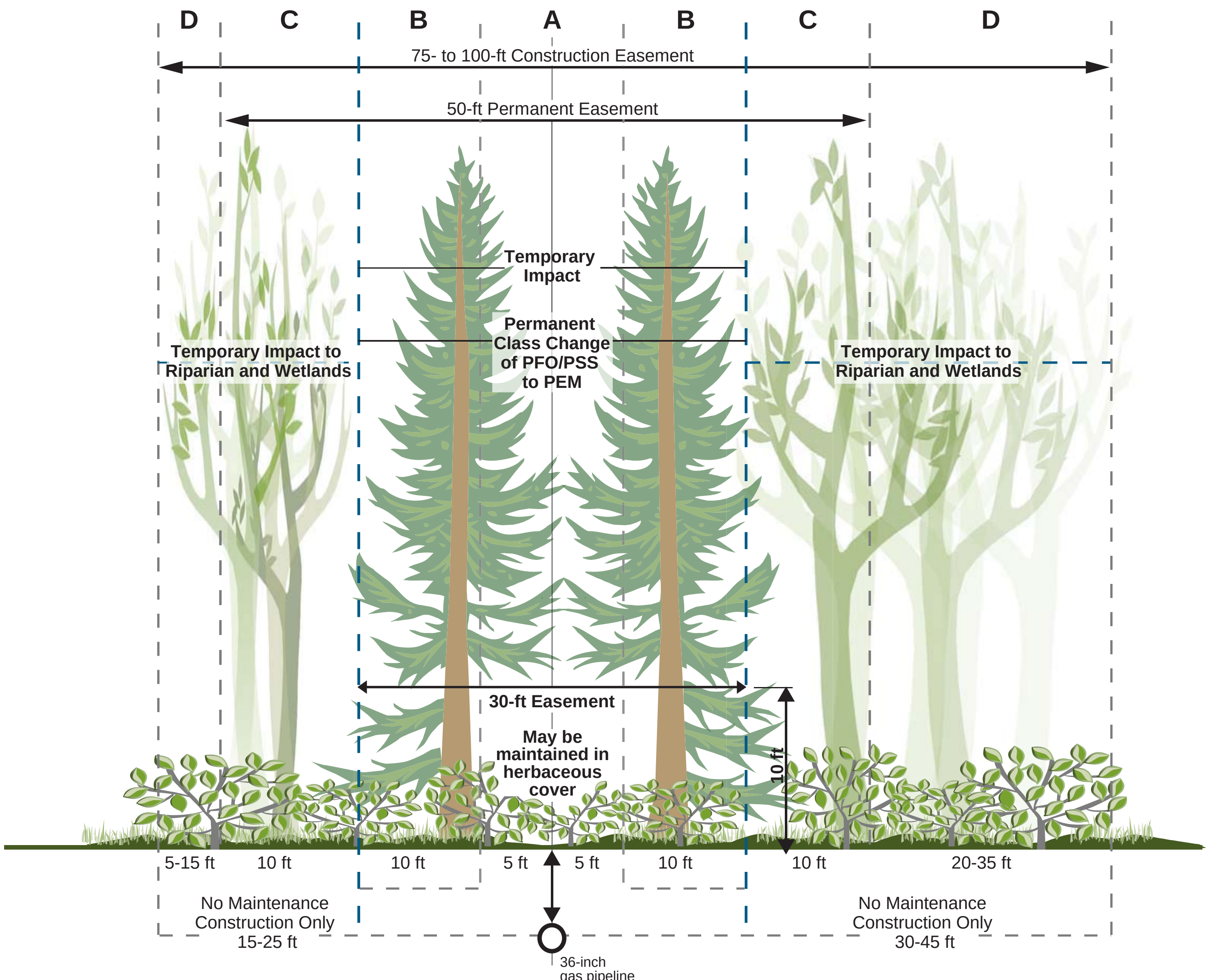


FIGURE 5-1

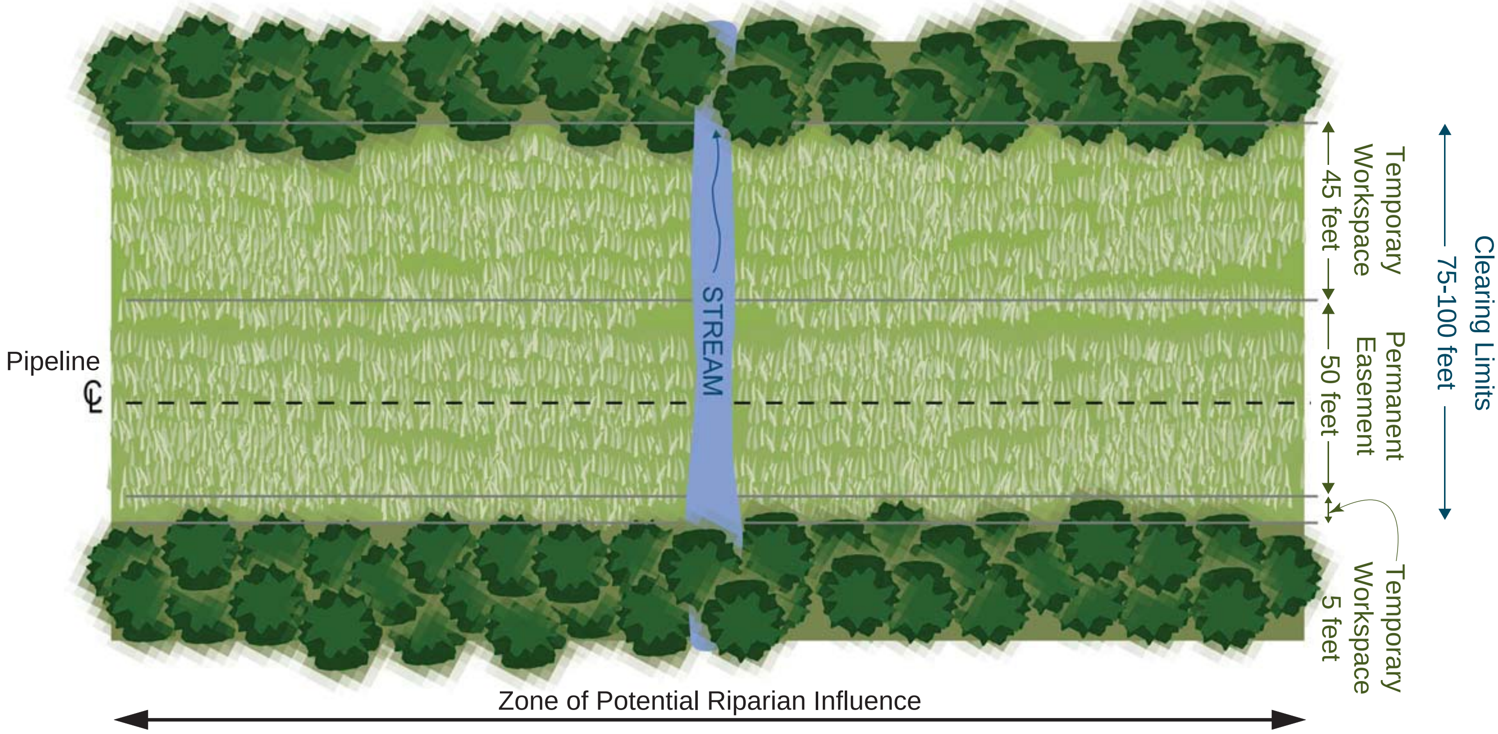
Conceptual Riparian and Forested Wetland Mitigation

OREGON LNG TERMINAL AND
OREGON PIPELINE PROJECT

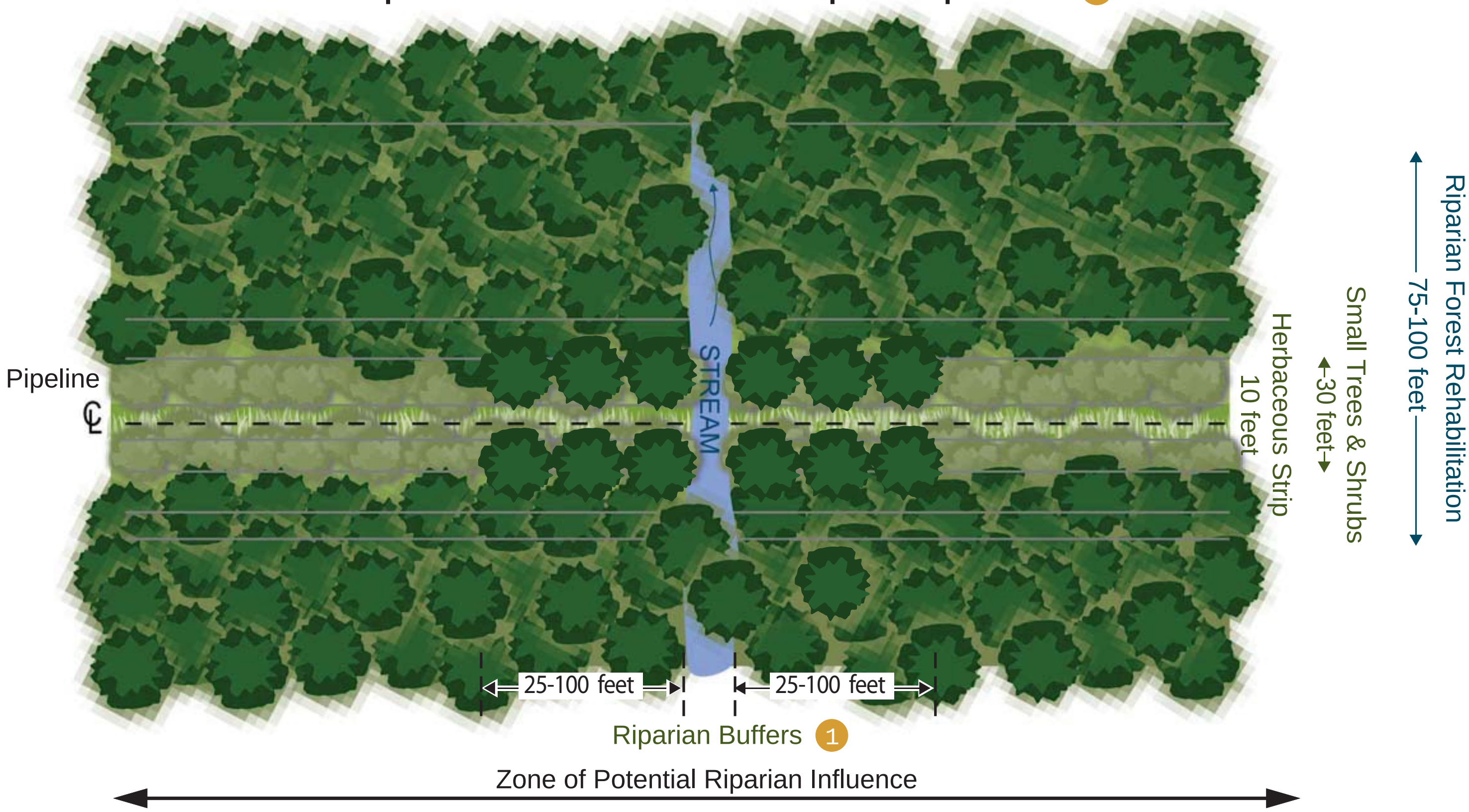
NOT TO SCALE

CH2MHILL

Vegetation Clearing for Pipeline Construction



Riparian Area Rehabilitation for Pipeline Operation 2



Mowing on 1- to 3-year cycle.

Trees exceeding 15 feet may be cut.

Trees free to grow.

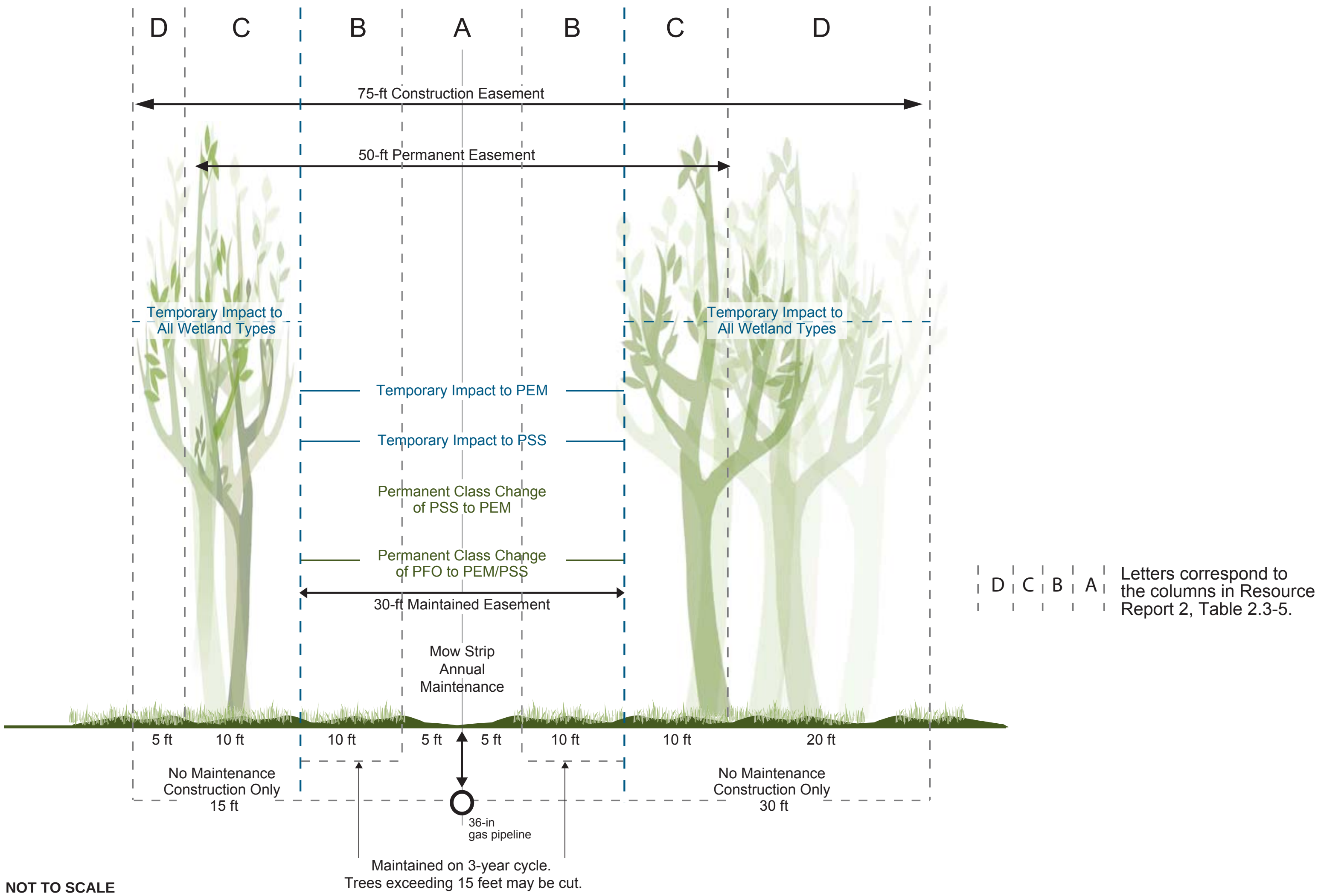
1 Width to match the greater of existing conditions or Oregon Forest Practices Act requirements.

2 Reforested only if trees removed during clearing, and with landowner permission.

FIGURE 5-2
Restoration for Streams with Existing Riparian Cover
OREGON LNG TERMINAL AND OREGON PIPELINE PROJECT

OregonLNG

CH2MHILL



NOT TO SCALE

OregonLNG

FIGURE 7-1
Typical Wetland Crossing Impacts

ES122007003PDX 355036.RR.02 Rv6 04-30-13 lh

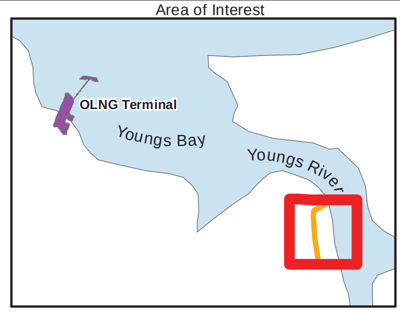
CH2MHILL

LEGEND

Youngs River Wetland Mitigation Site (193 acres)

Existing Dike

Parcel Boundary



0 250 500 1,000
Feet

N

Figure 7-2
Youngs River Wetland Mitigation Site

OregonLNG CH2MHILL.

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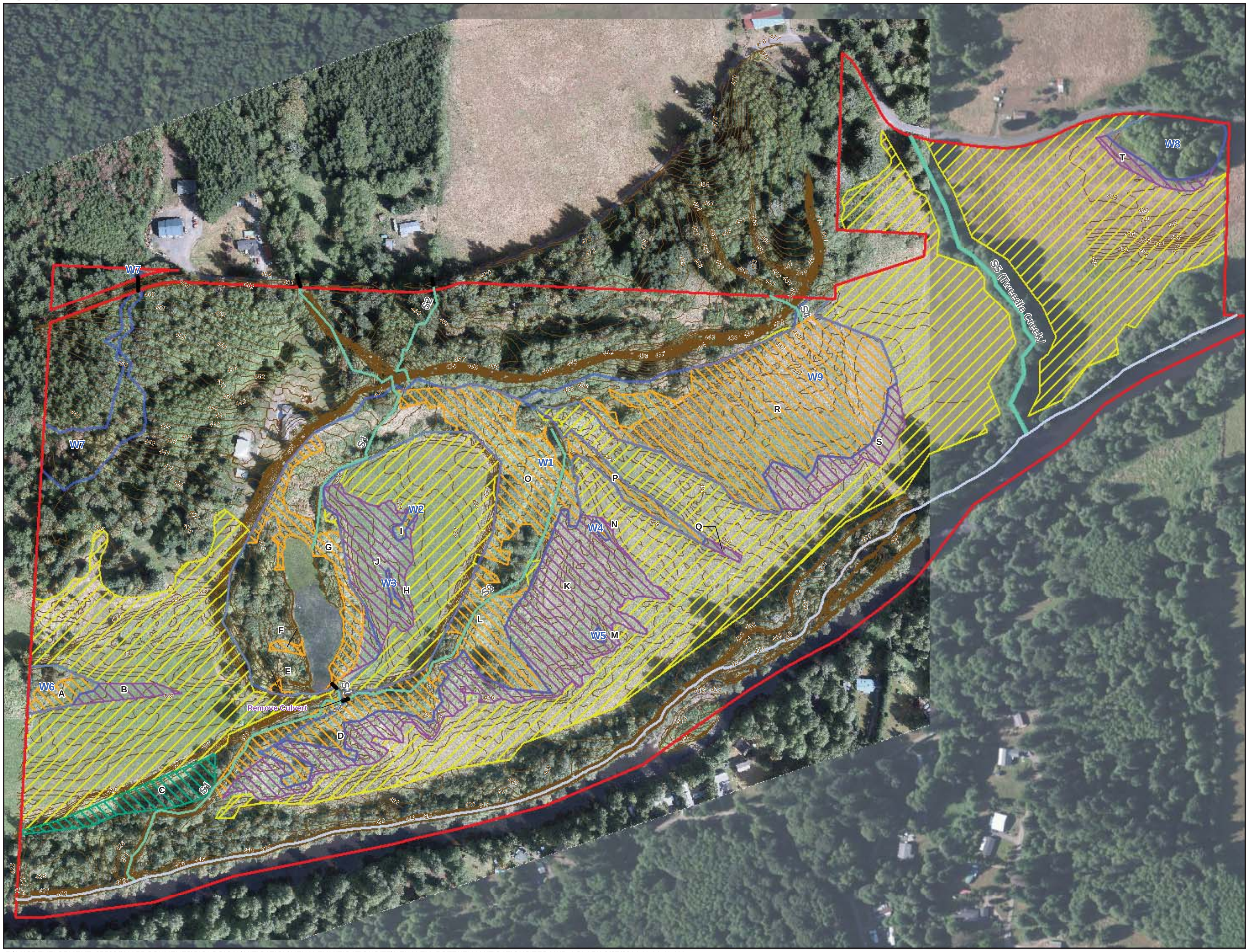

Figure 7-3
Proposed Wetland Mitigation Site — Nehalem River Property

OregonLNG

LEGEND

- Proposed Nehalem Mitigation Site
- Contour Index (5-foot)
- Contour Interval (1-foot)
- Culvert
- Stream
- OHW Line - Nehalem River
- Wetland

Wetland Mitigation Planting Zones (A-T)

- Creation (10.25 Acres)
- Enhancement (16.86 Acres)
- Restoration (1.07 Acres)
- Upland Revegetation Site (47.1 Acres)

N

0 200 400
Feet

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Appendix A
Wildlife Habitats by Oregon Fish and Wildlife Department Category with Mitigation Goals

APPENDIX A

Wildlife Habitats by Oregon Fish and Wildlife Department Category with Mitigation Goals

Habitat	ODFW Category	Explanation	Mitigation Goal
Terminal and Pipeline			
Upland Coniferous Forest **CF**	1	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. Old-growth forests as defined by the Regional Ecosystem Office (REO), age class 180+ years. Category 1 also includes nest patches (100-acre area around nest for northern spotted owl [NSO]), patches of trees where MAMU are nesting or potentially nesting, and nests for state and federally listed and sensitive/critical species (for example, bald eagles). Category 1 includes habitat for other state and federally listed and sensitive/critical species.	Avoidance. No loss of either habitat quantity or quality.
	2	Essential and limited habitat. Late-successional forests as defined by the REO, 80- to 179-year age class, with important habitat elements. Category 2 includes suitable habitat for NSO within an active NSO activity center (area within 1.5-mile radius of a nest patch).	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat or important and limited habitat. This includes mid-seral forests, 40- to 79-year age class. Category 3 includes Ponderosa pine woodlands, 3- to 39-year age class, as they are an Oregon Strategy Habitat.	No net loss of either habitat quantity or quality.
	4	Important habitat. Early seral stage forests, age class 3 to 39 years (excluding Ponderosa pine). In the context of this Project, these are typically managed timberlands. Contributor to sustaining populations of some common wildlife species over time.	No net loss of either existing habitat quantity or quality.
	5	Habitat having a high potential to become either essential or important habitat. Degraded habitats, clear-cuts (0- to 3-year age class), and habitats lacking soil to support plants. Plant cover is minimal and may be composed of weedy and invasive species. It includes sandy dredge spoils, sand dunes, or other soils that are devoid of vegetation.	Provide a net benefit in either habitat quantity or quality.
Upland Deciduous Forest **DF**	1	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. Mature oak woodlands and oak savannah (1 to 2 oak trees per acre) with native grassland component. Category 1 includes old-growth legacy oak trees. Category 1 includes habitat for state and federally listed and sensitive/critical species.	Avoidance. No loss of either habitat quantity or quality.
	2	Essential and limited habitat. Nonmature oak woodland (1 to 2 oak trees per acre).	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat or important and limited habitat. Category 3 includes forests other than oak, such as maple, alder, and cottonwood.	No net loss of either habitat quantity or quality.
	4	Important habitat. Contributor to sustaining populations of some common wildlife species over time. Category 4 includes early seral stages such as scrub-shrub habitat (for example, shrub hedgerows between farm fields).	No net loss of either existing habitat quantity or quality.
	5	Habitat having a high potential to become either essential or important habitat. Degraded habitats and habitats lacking soil to support plants. Plant cover is minimal and may be composed of weedy and invasive species. It includes sandy dredge spoils, sand dunes, or other soils that are devoid of vegetation.	Provide a net benefit in either habitat quantity or quality.

APPENDIX A

Wildlife Habitats by Oregon Fish and Wildlife Department Category with Mitigation Goals

Habitat	ODFW Category	Explanation	Mitigation Goal
Riparian Habitat **RH**	1	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. Patches of large trees with nest sites for marbled murrelets, eagles, and northern spotted owls. Category 1 habitat includes old-growth conifers and equivalent gallery forests of cottonwoods and other deciduous species. Category 1 includes habitat for state and federally listed and sensitive/critical species. See also CF and DF Category 1.	Avoidance. No loss of either habitat quantity or quality.
	2	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. Habitats composed of woody vegetation adjacent to perennial streams. In the Coast Range, the width of the riparian habitat is defined by rules in the Oregon Forest Practices Act (ORS 527, and its attendant rules, OAR Chapter 629, divisions 605 through 665) for private lands or in the Forest Management Plan for state forests.	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat or important and limited habitat. Young, or early seral stage habitats, such as scrub-shrub, that are either somewhat degraded or provide limited shading and minimal contributions to woody debris and nutrients (detritus). See Category 2 for riparian widths.	No net loss of either habitat quantity or quality.
	4	Important habitat. Degraded habitats dominated by weeds or non-native plants. Vegetation does not overhang stream banks and shading is very minimal. Contributions of woody debris and nutrients are low. This habitat type and category are equivalent to CF and DF Category 4.	No net loss of either existing habitat quantity or quality.
	5	Habitat having a high potential to become either essential or important habitat. This includes nonpaved trails and easements adjacent to streams. Presence of woody vegetation, shrubs, or trees, is absent. Where adjacent to streams, this habitat type is equivalent to CF and DF Category 5.	Provide a net benefit in either habitat quantity or quality.
Palustrine Scrub-shrub **PSS**	1	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. This includes scrub-shrub wetlands associated with bogs. PSS with state and federally listed and sensitive/critical species.	Avoidance. No loss of either habitat quantity or quality.
	2	Essential and limited habitat. Larger patches of PSS or interspersed with PFO, PEM, or open water.	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat or important and limited habitat. Smaller patches of PSS and those not interspersed with PEM, PFO, or open water.	No net loss of either habitat quantity or quality.
Palustrine Forested Wetland **PFO**	1	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. Old-growth wetland forests dominated by native species. These include PFO with mature stands of Oregon ash or cottonwood with characteristic native plants in the understory. PFO with state and federally listed and sensitive/critical species.	Avoidance. No loss of either habitat quantity or quality.
	2	Essential and limited habitat. Young stands or larger patches of PFO or interspersed with PEM, PSS, or open water.	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat or important and limited habitat. Early seral stage PFO of lower quality than Category 2 such as small areas of PFO or areas not interspersed with PEM, PSS, or open water.	No net loss of either habitat quantity or quality.

APPENDIX A

Wildlife Habitats by Oregon Fish and Wildlife Department Category with Mitigation Goals

Habitat	ODFW Category	Explanation	Mitigation Goal
Palustrine Emergent Wetland **PEM**	1	Irreplaceable, essential habitat; limited on a physiographic or site-specific basis. True wet prairie with native plants, vernal pools, or bogs. These are remnant patches representing historical conditions of this habitat type. Category 1 includes mineral seeps and mineral springs in the Coast Range. PEM with state and federally listed and sensitive/critical species.	Avoidance. No loss of either habitat quantity or quality.
	2	Essential and limited. Large areas of PEM and those interspersed with PFO, PSS, or open water.	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat or important and limited habitat. PEM habitat is disturbed, small in area, composed of non-native vegetation, or not interspersed with PSS, PFO, or OW habitats.	No net loss of either habitat quantity or quality.
	4	Important habitat. There are no Category 4 PEMs.	No net loss of either existing habitat quantity or quality.
	5	Habitat having a high potential to become either essential or important habitat. Farmed wetlands that are plowed on a regular basis. They have hydric soils and may be partially drained. These areas generally support ryegrass or other row crops.	Provide a net benefit in either habitat quantity or quality.
Estuarine and Estuarine Emergent Wetland **ES**	1	Irreplaceable, essential, and limited. This includes rocky tidepools and forested intertidal zones.	Avoidance. No loss of either habitat quality or quantity.
	2	Essential and limited habitat. Potentially suitable habitat for listed salmonids. Includes estuarine emergent wetlands that provide dendritic channel access to juvenile salmonids and other fish species and contribute nutrients to the estuarine system; and intertidal and shallow subtidal flats habitat to -6 feet MLLW.	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat, or important and limited habitat. High marsh habitat above the mean high water line, other emergent estuarine wetlands that do not allow access to juvenile salmonids (that is, lack dendritic channels), and deep subtidal/open water habitat beyond the -6 feet MLLW contour.	No net loss of either habitat quantity or quality.
Stream **ST**	1	Irreplaceable, essential, and limited habitat. In northwest Oregon, Category 1 for the ST habitat type includes Oregon chub habitat.	Avoidance. No loss of either habitat quantity or quality
	2	Essential and limited habitat. Critical or essential fish habitat for federally or state listed fish species. Nonfish-bearing streams with state or federally listed species and sensitive/critical species of reptiles or amphibians.	No net loss of either habitat quantity or quality, and provide a net benefit of habitat quantity or quality.
	3	Essential habitat, or important and limited habitat. Category 3 includes nonfish-bearing streams that do not provide habitat for sensitive/critical species of reptiles and amphibians.	No net loss of either habitat quantity or quality.
Agriculture/Pasture/ Orchard/Tree Farm **NO**	4	Important habitat. Noncultivated areas provide some habitat for wildlife. This may include hedgerows, perennial crops, orchards, vineyards, and tree farms (for example, Christmas trees). See also CF and DF Category 4.	No net loss of either existing habitat quantity or quality.
	5	Habitat having a high potential to become either essential or important habitat. Degraded by human actions or natural phenomena. Annually cultivated with limited wildlife habitat value, such as ryegrass fields and row crops. See also CF, DF, and PEM Category 5.	Provide a net benefit in either habitat quantity or quality.

APPENDIX A

Wildlife Habitats by Oregon Fish and Wildlife Department Category with Mitigation Goals

Habitat	ODFW Category	Explanation	Mitigation Goal
Developed/Buildings/ Roads **BP**	4	Important habitat. Category 4 includes utility easements and similar areas where maintenance and management are required at frequent (less than [<] 5-year) intervals. These areas are typically maintained in an early seral stage of succession (scrub-shrub) by frequent mowing or application of herbicides. Non-native and weedy species may be mixed with native species. See also CF, DF, PSS, and NO Category 4.	Provide a net benefit in either habitat quantity or quality.
	5	Habitat having a high potential to become either essential or important habitat. Degraded by human actions or natural phenomena. These areas (for example, unpaved roads and logging landings) are typically devoid of plants. They may be used as travel corridors for some species of wildlife, but they generally do not provide food or cover.	Provide a net benefit in either habitat quantity or quality.
	6	Low habitat value and low restoration potential. Not important in sustaining populations of wildlife species. Category 6 includes developed areas such as structures, roads, parking lots, and other impervious surfaces.	Minimize effects.
Rare Plants **RP**	1	Irreplaceable, essential, and limited habitat. The intent of this habitat is to ensure that locations of federally or state listed are captured as Category 1 habitats, regardless of patch size and surrounding habitat type. This is a default category for rare plants.	Avoidance. No loss of either habitat quantity or quality

Source: OARs 635-415-0000 to 635-415-0025, the ODFW Habitat Mitigation Policy.

Appendix B
Stormwater Pollution Prevention Plan with Erosion Prevention and Sediment Control Plan; Spill Prevention, Control, and Countermeasures Plan; and Frac-Out Contingency Plan

NOTE: This plan is proved as Appendix F1 of our EIS

Appendix C
Characteristics of Streams Crossed by the Pipeline

APPENDIX C

Characteristics of Streams Crossed by the Pipeline

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Bedrock Percentage	Boulder Percentage	Cobble Percentage	Rubble Percentage	Gravel Percentage	Fines Percentage	Gradient Percent	Embedded-ness	Bankfull Width (ft)	Bankfull Depth (ft)	Channel Type (Rosgen)	Fish Species[d]	Substrate Score[e]	Bankfull Score[f]	Scour Potential (Ave. of substrate and bankfull scores)[g]	Miles to Salmon Habitat	Preferred Work Period
1	S99CL001	Perennial	Adairs Slough	Lower Columbia	Method 2 - HDD	Minor							0		0	0		Co		1	0.5	0	November 1- Feb 28
1.5	S5BCL074	Perennial	Vera Creek	Lower Columbia	Method 2 - HDD	Minor							0		0	0		Co		1	0.5	0.49	November 1- Feb 28
3.1	S99CL067	Perennial	Lewis and Clark River	Lower Columbia	Method 2 - HDD	Minor							0		0	0		Co,FaCh		1	0.5	0.16	November 1- Feb 28
4.1	S5BCL059	Perennial	Tributary of Barrett Slough	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co		1	0.5	0.1	November 1- Feb 28
4.2	S5BCL062	Intermittent	Tributary of Barrett Slough	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.12	November 1- Feb 28
4.3	S5BCL063	Intermittent	Tributary of Barrett Slough	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.06	November 1- Feb 28
4.5	S5BCL064	Perennial	Barrett Slough	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co		1	0.5	0	November 1- Feb 28
4.6	S5BCL066	Intermittent	Tributary of Barrett Slough	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.11	November 1- Feb 28
4.8	S5BCL068	Intermittent	Tributary of Green Slough	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.3	November 1- Feb 28
4.8	S5BCL069	Intermittent	Tributary of Green Slough	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.39	November 1- Feb 28
4.9	S5BCL070	Intermittent	Unnamed	Lower Columbia	Method 3 - Open cut	Minor									2							0.2	November 1- Feb 28
5	S5BCL071	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 2 - HDD	Minor							0		0	0		FaCh		1	0.5	0.23	November 1- February 28
5.2	S5BCL072	Perennial	Tributary of Lewis and Clark	Lower Columbia	Method 2 - HDD	Minor							0		0	0		Co,FaCh		1	0.5	0.09	July 15- Sept. 15
5.7	S99CL064	Perennial	Lewis and Clark River	Lower Columbia	Method 2 - HDD	Major							0		0	0		Co,FaCh		1	0.5	0	July 15- Sept. 15
5.8	S38CL003	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 2 - HDD	Minor							0		0	0		Co		1	0.5	0.41	November 1- February 28
7.9	S1BCL001	Perennial	Heckard Creek	Lower Columbia	Method 1 - Flume	Intermediate							0		0	0		Co		1	0.5	0.02	July 1 - Sept. 15
8.1	S1BCL050	Intermittent	Unnamed	Lower Columbia	Method 3 - Open cut	Intermediate									10							0.13	July 15- Sept. 15
8.6	S1BCL002	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	1.17	July 1 - Sept. 15
8.8	S1BCL018	Perennial	Tributary of Lewis and Clark	Lower Columbia	Method 1 - Flume	Intermediate	0-5	0-5	0-5	0-5	0-5	95-100	1	5	25	1	C6	Co,FaCh	5	3	4	1.29	July 1 - Sept. 15
9.1	S1BCL003	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	0.86	July 1 - Sept. 15
9.3	S1BCL004	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	0.82	July 1 - Sept. 15
9.7	S1BCL005	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	0.97	July 1 - Sept. 15
9.7	S1BCL006	Ephemeral	Tributary of Lewis and Clark	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	0.96	July 1 - Sept. 15
9.9	S1BCL007	Intermittent	Tributary of Lewis and Clark	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	0.97	July 1 - Sept. 15
10	S1BCL008	Perennial	Tributary of Lewis and Clark	Lower Columbia	Method 1 - Flume	Intermediate							0		0	0		Co,FaCh		1	0.5	0.98	July 1 - Sept. 15
11	S99CL018	Perennial	Lewis and Clark River	Lower Columbia	Method 2 - HDD	Minor							0		0	0		Co,FaCh		1	0.5	0.08	July 1 - Sept. 15
12.8	S1BCL016	Perennial	Tributary of Speelyai Creek	Lower Columbia	Method 1 - Flume	Minor	0-5	40-45	40-45	15-20	0-5	0-5	14	1	10	1	A2a+	Co	2	2	2	1.03	July 1 - Sept. 15
13.8	S5BCL040	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor							0		0.8	0		Co,FaCh		1	0.5	2.02	July 1 - Sept. 15
13.8	S5BCL041	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor							0		2	0		Co,FaCh		1	0.5	2.03	July 1 - Sept. 15
13.9	S5BCL042	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	2.05	July 15- Sept. 30
13.9	S5BCL043	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	2.08	July 15- Sept. 30
14.1	S5BCL045	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co,FaCh		1	0.5	2.15	July 15- Sept. 30
14.2	S5BCL044	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co,FaCh		1	0.5	2.16	July 15- Sept. 30
14.8	S5BCL038	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	2.28	July 15- Sept. 30
15.3	S5BCL035	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	2.09	July 15- Sept. 30
15.6	S5BCL030	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	0-5	0-5	5-10	5-10	5-10	85-90	4	3	4	1.2	A5	Co,FaCh	5	1	3	2.11	July 15- Sept. 30
15.6	S5BCL034	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	55-60	40-45	4	2	4	2	A4	Co,FaCh	5	1	3	2.08	July 15- Sept. 30
15.8	S5BCL031	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	15-20	5-10	5-10	10-15	20-25	45-50	5	4	5	5	A5	Co,FaCh	4	2	3	2.25	July 15- Sept. 30
16.1	S99CL016	Perennial	Bayney Creek	Lower Columbia	Method 1 - Flume	Minor							9.1		0	0				1	0.5		July 15- Sept. 30
16.6	S5BCL032	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0.4	0		Co,FaCh		1	0.5	2.98	July 15- Sept. 30
17.3	S5BCL077	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co,FaCh		1	0.5	3.61	July 15- Sept. 30
17.8	S5BCL079	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	0-5	5-10	10-15	10-15	25-30	40-45	4	3	5	0		Co,FaCh	4	2	3	4.09	July 15- Sept. 30
17.8	S5BCL078	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	0-5	5-10	15-20	20-25	35-40	25-30	2	3	6	1		Co,FaCh	4	2	3	4.05	July 15- Sept. 30
17.9	S5BCL080	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	4.2	July 15- Sept. 30
18.4	S5BCL076	Perennial	Tributary of Rock Creek	Lower Columbia	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	40-45	60-65	2	3	4	2	B4	Co,FaCh	5	1	3	4.64	July 15- Sept. 30
18.5	S1BCL009	Perennial	Rock Creek	Lower Columbia	Method 1 - Flume	Intermediate	0-5	0-5	20-25	25-30	40-45	15-20	1.5	1	17	2.4	C4	Co,FaCh	2	2	2	4.78	July 15- Sept. 30
18.8	S1BCL010	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	5.08	July 15- Sept. 30
19	S1BCL011	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	0-5	0-5	15-20	15-20	15-20	55-60	4	4	6	1		Co,FaCh	4	2	3	5.25	July 15- Sept. 30
19.1	S1BCL012	Intermittent	Unnamed	Lower Columbia	Method 3 - Open cut	Minor							0		0	0				1	0.5	2.93	July 15- Sept. 30
19.3	S1BCL014	Perennial	Osgood Creek	Lower Columbia	Method 1 - Flume	Minor				0-5	55-60	40-45	1	1	20	3	C4	Co,FaCh	5	3	4	5.55	July 15- Sept. 30
19.6	S2BCL013A	Perennial	Tributary of Osgood Creek	Lower Columbia	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	90-95	0	2	7	3		Co,FaCh	5	2	3.5	5.79	July 15- Sept. 30
20.1	S2BCL013B	Perennial	Fox Creek	Lower Columbia	Method 1 - Flume	Intermediate	0-5	0-5	25-30	35-40	25-30	5-10	3	1	35	2	B3a	Co,FaCh	3	3	3	6.1	July 15- Sept. 30
21.4	S38CL013	Perennial	South Fork Youngs River	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co,FaCh		1	0.5	7.16	July 15- Sept. 30
21.6	S42CL003	Intermittent	Unnamed	lower Columbia	Method 3 - Open cut	Minor																2.83	July 15- Sept. 30
21.8	S5BCL058	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Intermediate	10-15	10-15	15-20	40-45	20-25	0-5	4	1	15	3	B3a	Co,FaCh	3	2	2.5	7.58	July 15- Sept. 30
22.1	S5BCL049	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	0-5	0-5	0-5	5-10	40-45	50-55	10	2	2.5	1.5	A5	Co,FaCh	5	1	3	7.85	July 15- Sept. 30
22.2	S5BCL048	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	7.92	July 15- Sept. 30
22.5	S6BCL016	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	8.2	July 15- Sept. 30
22.6	S6BCL014	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor									4			Co,FaCh				8.29	July 15- Sept. 30
22.6	S6BCL013	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor									1			Co,FaCh				8.28	July 15- Sept. 30
22.6	S6BCL015	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	8.23	July 15- Sept. 30
22.8	S6BCL017	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	8.51	July 15- Sept. 30
22.8	S6BCL010	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor									2			Co,FaCh				8.49	July 15- Sept. 30
22.8	S6BCL011	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor									2			Co,FaCh				8.45	July 15- Sept. 30
22.9	S6BCL018	Intermittent	Tributary of Fall Creek	Lower Columbia	Method 3 - Open cut	Minor	25-30	5-10	5-10	20-25	30-35	10-15	7	4	20	3		Co,FaCh	3	3	3	8.62	July 15- Sept. 30
23	S6BCL019	Perennial	Tributary of Fall Creek	Lower Columbia	Method 1 - Flume	Intermediate							0		0	0		Co,FaCh		1	0.5	8.66	July 15- Sept. 30
23.1	S6BCL020	Intermittent	Tributary of Fall Creek	Lower Columbia	Method 3 - Open cut	Minor							0		0	0		Co,FaCh		1	0.5	8.77	July 15- Sept. 30
23.4	S38CL014	Perennial	Fall Creek	Lower Columbia	Method 1 - Flume	Minor							0		0	0		Co,FaCh		1	0.5	9.11	July 15- Sept. 30
24.3	S5BCL016	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	90-95	11		3.5	0.1		Co,FaCh	5	1	3	2.36	July 1- Aug. 31

APPENDIX C
Characteristics of Streams Crossed by the Pipeline

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Bedrock Percentage	Boulder Percentage	Cobble Percentage	Rubble Percentage	Gravel Percentage	Fines Percentage	Gradient Percent	Embedded-ness	Bankfull Width (ft)	Bankfull Depth (ft)	Channel Type (Rosgen)	Fish Species[d]	Substrate Score[e]	Bankfull Score[f]	Scour Potential (Ave. of substrate and bankfull scores)[g]	Miles to Salmon Habitat	Preferred Work Period
24.4	S5BCL018	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	5-10	10-15	15-20	30-35	40-45	9		3.5	0.1		Co,FaCh	4	1	2.5	2.32	July 1- Aug. 31
24.4	S5BCL017	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	5-10	10-15	25-30	35-40	25-30	12	5	6	1	A5a+	Co,FaCh	4	2	3	2.34	July 1- Aug. 31
24.8	S2BCL001	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	20-25	35-40	15-20	5-10	7		7	0		Co,FaCh	2	2	2	2.09	July 1- Aug. 31
24.8	S2BCL002	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Intermediate	50-55	0-5	0-5	0-5	15-20	15-20	7		25	0		Co,FaCh	3	3	3	2.08	July 1- Aug. 31
25.1	S2BCL003	Ephemeral	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor							34		0	0		Co,FaCh	2	1	1.5	1.97	July 1- Aug. 31
25.2	S2BCL005	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Intermediate							0		0	0		Co,FaCh		1	0.5	1.96	July 1- Aug. 31
25.2	S2BCL004	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	5-10	50-55	20-25	15-20	10-15	34		10	0		Co,FaCh	2	2	2	1.96	July 1- Aug. 31
25.3	S2BCL007	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	15-20	25-30	40-45	15-20	13	1	3	0.1	A4a+	Co,FaCh	2	1	1.5	1.95	July 1- Aug. 31
25.4	S2BCL008A	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Intermediate							0		0	0		Co,FaCh		1	0.5	1.95	July 1- Aug. 31
25.7	S2BCL009	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Intermediate	20-25	0-5	15-20	25-30	15-20	20-25	4	2	10	0.1	B1a	Co	3	2	2.5	4.29	July 1- Aug. 31
25.7	S2BCL010	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	4.27	July 1- Aug. 31
25.9	S2BCL012	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	4.19	July 1- Aug. 31
26.3	S5BCL019	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	15-20	85-90	9	5	1.2	0.2	A5	Co	5	1	3	3.87	July 1- Aug. 31
26.5	S5BCL029	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	15-20	85-90	18		1.5	0.2	A5+	Co	5	1	3	3.68	July 1- Aug. 31
26.6	S5BCL027	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	95-100	6		1	0.2	A5	Co	5	1	3	3.63	July 1- Aug. 31
26.6	S5BCL028	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor							0		3	0		Co		1	0.5	3.63	July 1- Aug. 31
26.8	S5BCL023	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	95-100	23		1.3	0.2	A5	Co	5	1	3	3.4	July 1- Aug. 31
26.8	S5BCL025	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor							17		1.4	0.7	A5a+	Co		1	0.5	3.41	July 1- Aug. 31
27	S5BCL022	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	23		0	0		Co	5	1	3	3.27	July 1- Aug. 31
27.2	S5BCL021	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	95-100	2		6	0.2	B4	Co	5	2	3.5	3.05	July 1- Aug. 31
27.3	S5BCL020	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	95-100	4		1.8	0.2	A4	Co	5	1	3	2.97	July 1- Aug. 31
27.4	S5BCL015	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	5-10	95-100	13		4	0.2	A5a+	Co	3	1	2	2.89	July 1- Aug. 31
27.6	S5BCL014	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	6		2.4	0.2		Co	5	1	3	2.68	July 1- Aug. 31
27.8	S5BCL012	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	10		2	0.1		Co	5	1	3	2.55	July 1- Aug. 31
27.8	S5BCL013	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	16		2	4		Co	5	1	3	2.56	July 1- Aug. 31
27.9	S5BCL011	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	0-5	5-10	5-10	10-15	30-35	45-50	10	4	3	1	A5	Co	2	1	1.5	2.46	July 1- Aug. 31
28.1	S5BCL010	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	30-35	55-60	6		3.5	0.5		Co	2	1	1.5	2.35	July 1- Aug. 31
28.4	S5BCL007	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	0		6	6		Co	5	2	3.5	1.24	July 1- Sept. 15
28.5	S5BCL004	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	7		7	2.5		Co	5	2	3.5	1.13	July 1- Sept. 15
28.5	S5BCL005	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	5		4	0.1		Co	5	1	3	1.19	July 1- Sept. 15
29	S5BCL001	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	0		3	3.5		Co	5	1	3	0.79	July 1- Sept. 15
29	S5BCL002	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.81	July 1- Sept. 15
29.4	S6BCL007	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co, FaCh		1	0.5	0.81	July 1- Sept. 15
29.4	S6BCL008	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co, FaCh		1	0.5	0.8	July 1- Sept. 15
29.5	S6BCL006	Perennial	Tributary of East Humbug Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	5-10	20-25	65-70	7	2	7	1	A5	Co	5	2	3.5	0.79	July 1- Sept. 15
29.5	S6BCL005	Perennial	Tributary of East Humbug Creek	Nehalem	Method 1 - Flume	Minor																0.78	July 1- Sept. 15
29.9	S6BCL004	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor																0.59	July 1- Sept. 15
30.9	S2BCL021	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.72	July 1- Sept. 15
31.4	S2BCL008B	Perennial	Alder Creek	Nehalem	Method 1 - Flume	Intermediate							0		0	0		Co		1	0.5	0	July 1- Sept. 15
31.6	S6BCL001	Intermittent	Tributary of Alder Creek	Nehalem	Method 3 - Open cut	Minor	0-5	5-10	20-25	5-10	20-25	30-35	10	3	6	1.5	A3	Co	3	2	2.5	0.78	July 1- Sept. 15
32	S3BCL001	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	75-80	25		6	1		Co,SpCh,FaCh	5	2	3.5	0.69	July 1- Aug. 31
32	S3BCL002	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	75-80	13		6	1		Co,SpCh,FaCh	5	2	3.5	0.68	July 1- Aug. 31
32.1	S3BCL003	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	75-80	15		4	1		Co,SpCh,FaCh	5	1	3	0.67	July 1- Aug. 31
32.1	S3BCL004	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	75-80	11		6	1		Co,SpCh,FaCh	5	2	3.5	0.66	July 1- Aug. 31
32.3	S3BCL005	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	90-95	7		8	0		Co,SpCh,FaCh	5	2	3.5	0.67	July 1- Aug. 31
32.3	S3BCL006	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	90-95	7		6	0		Co,SpCh,FaCh	5	2	3.5	0.67	July 1- Aug. 31
32.4	S3BCL007	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	10-15	90-95	12		8	5		Co,SpCh,FaCh	5	2	3.5	0.68	July 1- Aug. 31
33.5	S99CL108	Perennial	Nehalem River	Nehalem	Method 2 - HDD	Major							0		0	0		Co,SpCh,FaCh		1	0.5	0	July 1- Aug. 31
34.4	S5BCL046	Perennial	Tributary of Nehalem River	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	95-100	14		2	0.5	A6a+	Co,SpCh,FaCh	5	1	3	1.06	July 1- Aug. 31
36.2	S3BCL101	Perennial	Unnamed	Nehalem	Method 1 - Flume																		July 1- Aug. 31
36.3	S3BCL102	Perennial	Unnamed	Nehalem	Method 1 - Flume																		July 1- Aug. 31
37.5	S8BCL004	Perennial	Tributary of North Fork Quartz	Nehalem	Method 1 - Flume																	0.47	July 1- Aug. 15
37.7	S8BCL003	Intermittent	Tributary of North Fork Quartz	Nehalem	Method 3 - Open cut																	0.54	July 1- Aug. 15
38.5	S8BCL001	Perennial	Tributary of South Fork Quartz	Nehalem	Method 1 - Flume																	1.28	July 1- Aug. 15
39.6	S1BCL029	Intermittent	Tributary of Military Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.28	July 1- Aug. 31
39.8	S1BCL027	Intermittent	Tributary of Military Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.17	July 1- Aug. 31
39.8	S1BCL028	Intermittent	Tributary of Military Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.18	July 1- Aug. 31
41	S8BCL005	Perennial	Rock Creek	Nehalem	Method 2 - HDD	Intermediate	15-20	0-5	5-10	20-25	15-20	55-60	2	3	20	0.3	F5b	Co	4	3	3.5	0	July 1- Aug. 31
42.3	S8BCL009	Perennial	Tributary of South Fork Rock	Nehalem	Method 1 - Flume	Intermediate							0		11	0		Co		1	0.5	0	July 1- Aug. 31
42.7	S1BCL020	Perennial	Tributary of South Fork Rock	Nehalem	Method 1 - Flume	Minor	0-5	25-30	20-25	15-20	0-5	50-55	8	5	6	3	A2a+	Co	3	2	2.5	0.03	July 1- Aug. 31
43.1	S1BCL021	Perennial	South Fork Rock Creek	Nehalem	Method 2 - HDD	Intermediate	0-5	0-5	10-15	35-40	40-45	15-20	1	2	15	1	C4	Co	3	2	2.5	0	July 1- Aug. 31
43.4	S1BCL022	Perennial	Bear Creek	Nehalem	Method 2 - HDD	Intermediate	0-5	0-5	0-5	0-5	50-55	50-55	1	3	12	1		Co	5	2	3.5	0	July 1- Aug. 31
43.5	S1BCL023	Intermittent	Tributary of Bear Creek	Nehalem	Method 2 - HDD	Minor							0		0	0		Co		1	0.5	0.04	July 1- Aug. 31
43.7	S1BCL024	Perennial	Tributary of Bear Creek	Nehalem	Method 1 - Flume	Minor							0		0	0		Co		1	0.5	0.09	July 1- Aug. 31
43.9	S1BCL025	Intermittent	Tributary of Bear Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	2	5	4	1		Co	5	1	3	0.12	July 1- Aug. 31
44	S1BCL026	Intermittent	Tributary of Bear Creek	Nehalem	Method 3 - Open cut	Minor	0-5	0-5	0-5	0-5	0-5	95-100	4	5	3	1		Co	5	1	3	0.11	July 1- Aug. 31
44.2	S1BTI001	Perennial	Bear Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	0-5	95-100	1	5	6	2		Co	5	2	3.5	0.18	July 1- Aug. 31
44.3	S1BTI002	Intermittent	Tributary of Bear Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co		1	0.5	0.27	July 1- Aug. 31
44.8	S5BTI001	Perennial	Tributary of Wolf Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	25-30	65-70	6	3	5	0.1	A4a+	Co	5	2	3.5	0.59	July 1- Sept. 15

APPENDIX C

Characteristics of Streams Crossed by the Pipeline

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Bedrock Percentage	Boulder Percentage	Cobble Percentage	Rubble Percentage	Gravel Percentage	Fines Percentage	Gradient Percent	Embedded-ness	Bankfull Width (ft)	Bankfull Depth (ft)	Channel Type (Rosgen)	Fish Species[d]	Substrate Score[e]	Bankfull Score[f]	Scour Potential (Ave. of substrate and bankfull scores)[g]	Miles to Salmon Habitat	Preferred Work Period
45.1	S1BTI003	Intermittent	Tributary of Wolf Creek	Nehalem	Method 3 - Open cut	Minor							0		0	0		Co,SpCh		1	0.5	2.41	July 1- Aug. 31
47.6	S6BCO002	Perennial	North Fork Wolf Creek	Nehalem	Method 1 - Flume	Intermediate												Co, SpCh, St				0.00	July 1 - August 31
48.3	S1BCO000	Perennial	Tributary of North Fork Wolf Cree	Nehalem	Method 1 - Flume	Minor												not confirmed				0.64	July 1 - August 31
50.5	S3BCO012	Perennial	Clear Creek	Nehalem	Method 1 - Flume	Intermediate							0		0	0		Co		1	0.5	0.03	July 1 - August 31
53.6	S3BCO002	Perennial	Fall Creek	Nehalem	Method 1 - Flume	Minor												not confirmed				2.28	July 1 - August 31
55.7	S3BCO107	Perennial	Cedar Creek	Nehalem	Method 1 - Flume	Intermediate	0-5	0-5	0-5	10-15	35-40	55-60	2	4	10	3		Co	4	2	3	0.01	July 1 - August 31
55.8	S3BCO106	Perennial	Tributary of Cedar Creek	Nehalem	Method 1 - Flume	Minor	0-5	0-5	0-5	10-15	55-60	35-40	4	3	4	4		not confirmed	4	1	2.5	0.21	July 1 - August 31
57.7	S3BCO101B	Perennial	Braided Channel to Rock Creek	Nehalem	Method 2 - HDD	Intermediate	0-5	0-5	0-5	0-5	0-5	95-100	2		30	30		Co, SpCh, St	5	3	4	0.00	July 1 - August 31
57.7	S3BCO100	Perennial	Tributary of Rock Creek	Nehalem	Method 2 - HDD	Intermediate																0.01	July 1 - August 31
57.7	S3BCO101	Perennial	Rock Creek	Nehalem	Method 2 - HDD	Intermediate																0.00	July 1 - August 31
63.8	S3BCO014	Perennial	Nehalem River	Nehalem	Method 2 - HDD	Intermediate	0-5	0-5	0-5	0-5	0-5	95-100	2	3	30	10		Co, SpCh, St	5	3	4	0.00	July 1 - August 31
66.3	S3BCO103	Intermittent	Tributary of Oak Ranch Creek	Nehalem	Method 3 - Open cut	Minor												not confirmed				0.94	July 1 - August 31
67.7	S6BCO004	Intermittent	Unnamed	Nehalem	Method 3 - Open cut	Minor																0.38	July 1 - August 31
68.0	S6BCO003	Perennial	Unnamed	Nehalem	Method 1 - Flume	Minor																0.49	July 1 - August 31
70.2	S3BCO003	Intermittent	Tributary of Clatskanie River	Lower Columbia-Clatskanie	Method 3 - Open cut	Intermediate												not confirmed				0.59	July 1 - August 31
70.7	S99CO020	Perennial	Clatskanie River	Lower Columbia-Clatskanie	Method 1 - Flume	Intermediate																0.00	July 1 - August 31
71.0	S99CO021	Perennial	Unnamed	Lower Columbia-Clatskanie	Method 1 - Flume	Minor																0.19	July 1 - August 31
71.8	S5BCO001	Perennial	Little Clatskanie River	Lower Columbia-Clatskanie	Method 1 - Flume	Minor												Co				0.06	July 1 - August 31
72.7	S3BCO008	Perennial/Intermittent	Tributary of Milton Creek	Lower Willamette	Method 1 - Flume	Minor												not confirmed				0.24	July 15 - August 31
73.0	S3BCO010	Perennial	Milton Creek	Lower Willamette	Method 1 - Flume	Intermediate												Co, St				0.02	July 15 - August 31
73.5	S1BCO004	Intermittent	Apilton Creek	Lower Willamette	Method 3 - Open cut	Minor												not confirmed				0.54	July 15 - August 31
73.6	S1BCO005	Intermittent	Tributary of Apilton Creek	Lower Willamette	Method 3 - Open cut	Minor												not confirmed				0.58	July 15 - August 31
74.5	S5BCO011	Perennial	Unnamed	Lower Willamette	Method 1 - Flume	Minor																0.12	July 15-September 15
74.6	S5BCO010	Perennial	Unnamed	Lower Willamette	Method 1 - Flume	Intermediate																0.12	July 15-September 15
74.9	S6BCO001	Perennial	Milton Creek	Lower Willamette	Method 1 - Flume	Intermediate																0.00	July 15-September 15
76.3	S3BCO110	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3	Minor	0-5	0-5	0-5	0-5	30-35	70-75	12	4	2	1	A5a+	not confirmed	5	1	3	0.23	July 15-September 15
76.4	S3BCO017	Perennial	Merrill Creek	Lower Columbia-Clatskanie	Method 1 - Flume	Intermediate																0.00	July 15-September 15
78.2	S2BCO009	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3	Minor												not confirmed				0.38	July 15-September 15
78.4	S3BCO122	Perennial	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 1 - Flume	Intermediate	0-5	0-5	10-15	10-15	30-35	50-55	4	3	12	2		Co	4	2	3	0.20	July 15-September 15
79.0	S3BCO120	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3	Minor												not confirmed				0.87	July 15-September 15
79.0	S3BCO119	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3	Minor	0-5	0-5	0-5	0-5	5-10	95-100	4	4	1	1	A6	not confirmed	5	1	3	0.92	July 15-September 15
79.9	S3BCO115	Perennial	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 1 - Flume	Minor	0-5	0-5	0-5	0-5	5-10	95-100	17	4	2	2	A5a+	not confirmed	5	1	3	2.01	July 15-September 15
81.6	S99CO011	Perennial	Deer Island Slough	Lower Columbia-Clatskanie	Method 1 - Flume	Intermediate									38			not confirmed		1	0.5	0.46	July 15-September 15
82.0	S3BCO123	Perennial	Dyna Nobel Channel	Lower Columbia-Clatskanie	Method 2 - HDD	Intermediate									20			not confirmed		1	0.5	0.45	July 15-September 15
82.3	S99CO014	Perennial	Columbia River	Lower Columbia-Clatskanie	Method 2 - HDD	Major									3300			not confirmed		1	0.5	0.00	November 1-February 28
83.3	S99CW020	Perennial	Burris Creek	Lewis	Method 1 - Flume	Intermediate									10			not confirmed				0.00	August 1-August 31
85.8	S99CW021	Perennial	Unnamed	Lewis	Method 1 - Flume	Minor									2			not confirmed				0.36	August 1-August 31
86	S99CW022	Perennial	Unnamed	Lewis	Method 1 - Flume	Minor									2			not confirmed				0.31	August 1-August 31
86.5	S99CW023	Intermittent	Unnamed	Lewis	Method 1 - Flume	Proxy									3			not confirmed				0.48	August 1-August 15
86.7	S99CW025	Intermittent	Unnamed	Lewis	Method 1 - Flume	Proxy									3			not confirmed				0.40	August 1-August 15
86.8	S99CW026	Perennial	Unnamed	Lewis	Method 1 - Flume	Proxy									3			not confirmed				0.39	August 1-August 15

[a] As determined by field observation or the U.S. Geological Survey (USGS) 7.5-minute topographic maps. Intermittent: has surface flow for at least 3 months out of the year and has a connection to

[b] Waterbody names are as depicted on USGS 7.5-minute topographic maps.

[c] Stream designation includes minor, intermediate, and major waterbodies crossed by the Project. Minor waterbodies include all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing; intermediate waterbodies include all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and major waterbodies include all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

[d] Fisheries classifications within the state of Oregon are considered to be coldwater fisheries (see Resource Report 3 for more information).

[e] Substrate Score column: The substrate score is based on percent fines, embeddedness, and professional judgment for salmonid spawning substrate. Scores are on a scale of 1-5 with 1 being the best salmonid spawning habitat and 5 being the worst.

[f] Bankfull Score column: The bankfull width score is based on the bankfull width of the channel. Scores are on a scale of 1-5 with 1 representing the narrowest channels and 5 representing the widest channels.

[g] Scour Potential (Ave. of substrate and bankfull width scores) column: The scour potential is the average of the substrate and bankfull width scores and represents the potential for vertical and/or horizontal scour. Scour potential is on a scale of 1-5 with 1 representing low scour potential typically because the stream is small with a high percentage of boulder, cobble, rubble, gravel substrate and low energy flows. A 5 represents larger channels with higher energy flows and a high percentage of fines and/or gravel.

Abbreviations:

Co = Coho Salmon
E = Ephemeral
FaCh = Fall Chinook Salmon
I = Intermittent
MP = Milepost
NA = Not available
NDA = No data available
P = Perennial

Proxy Data = These data were provided by the National Wetlands Inventory (NWI) database, the Warrington Local Wetland Inventory (LWI) database, the Pacific Northwest (PNW) Hydrography Framework, and the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database.
The data do not include certain information, such as stream type, stream width, or wetland type. Once the final pipeline route is approved and access to these areas is secured, these data will be collected.

SpCh = Spring Chinook Salmon
St = Winter Steelhead

Additional Notes:

Widths in feet are stream ordinary high water mark (OHWM).
Stream ID numbers beginning in S99 are for areas with no field access and are based on aerial photo and Pacific Northwest Hydrography Network database.
Remaining data are from field surveys.
Duplicate milepost numbers occur because of rounding of mileposts to nearest tenth of a mile.
Precision loss may occur because of rounding.

Appendix D
Probabilistic Analysis of ESA-Listed Salmonid Entrainment at Ballast and Cooling Water Intakes

TECHNICAL MEMORANDUM

Oregon LNG: Probabilistic Analysis of ESA-Listed Salmonid Entrainment at Ballast and Cooling Water Intakes

TO: Mark Bricker/SEA
Jay Lorenz/PDX

FROM: Dan Pitzler/SEA
Aaron Hallerman/SEA
Bob Ellis, Ellis Ecological Services, Inc.
Dave DeKrey, Ellis Ecological Services, Inc.

DATE: August 27, 2009

Introduction

Oregon LNG is proposing to construct a liquefied natural gas (LNG) Terminal near Warrenton, Oregon. While unloading, LNG carriers (LNGCs) take on ballast and cooling water, which is accomplished through openings in the hull known as "seachests." These seachests are not screened to exclude juvenile fish and, as such, there is the potential for fish listed under the Endangered Species Act (ESA) in the Lower Columbia River Estuary (LCRE) to be entrained or impinged. Oregon LNG is currently pursuing methods to screen or otherwise exclude juvenile salmonids from ballast and cooling water intakes. However, because of numerous technical and operational challenges, development of a screening or exclusion system has proven challenging. The purpose of this technical memorandum is to estimate the potential number of individual fish that could be entrained from each Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS) of ESA-listed salmonids if screens are not used or if screens fail during use.

It is assumed that because of their relatively large size and good swimming ability during estuarine residency, adult eulachon (proposed for threatened status), adult salmon, and adult and subadult green sturgeon will not be susceptible to entrainment. Larval eulachon will be susceptible to entrainment but—because of their small size—would not be excluded from ballast tanks even if screens were employed. There is also concern for the entrainment of juvenile Pacific lamprey, an unlisted species that is potentially in decline and is culturally important to Native American tribes. Unfortunately, there are no data on lamprey abundance, distribution, or behavior in the LCRE, making estimates on their entrainment impossible. Juvenile lamprey have been shown to be relatively poor swimmers, and therefore are likely susceptible to entrainment.

Throughout this technical memorandum, the word "entrainment" will be used as a surrogate for both entrainment and impingement since both have the same effect—mortality of the entrained or impinged fish. This modeling addresses only juvenile salmonids, as adults of those species are strong swimmers and are able to avoid entrainment. Therefore, any reference to "fish" is in regard to juvenile salmonids. The only other listed or proposed species in the LCRE is green sturgeon. Green sturgeon subadults are at least 1.5 years old upon entry into the Columbia River estuary, and large enough to avoid entrainment. Although some unlisted species present in the LCRE may be susceptible to entrainment, population density and distribution data for those species (perhaps with the exception of white sturgeon) are so limited that they preclude reasonably accurate prediction of those species' entrainment potential. Nonetheless, impacts to unlisted species will be addressed in subsequent documents outlining proposed mitigation activities.

This technical memorandum provides an update to a previously published technical memorandum on this topic[1] (the "May 22 memo").

In the analysis conducted and reported in the May 22 memo, many assumptions were made about uncertain variables that assumed the conservative "worst case." Thus, the resulting entrainment estimates were similarly conservative. Throughout this updated memorandum, the assumptions of the May 22 memo are included and briefly discussed for comparison purposes. After reviewing earlier versions of the May 22 memo, regulatory agencies requested a sensitivity analysis that could be used to establish confidence limits around the entrainment estimates. This updated memorandum discusses a revised entrainment estimate methodology in which published research and expert opinion were used to assign probability distributions and outcomes to a series of key uncertain variables. Probabilistic fish entrainment estimates were then developed using Monte Carlo simulation.

Monte Carlo Simulation Methods

Monte Carlo simulation calculates fish entrainment by taking a random sample of each specified distribution. This result is saved and the simulation is run again, and the result is saved. This process continues for 10,000 simulations. The final result is a probability distribution for fish entrainment that encapsulates the accumulated knowledge of all the uncertain variables.

Ideally, the selection of probability distributions for key variables should be based on consideration of the underlying physical processes or mechanisms thought to drive the observed variability. For example, if a key variable is the result of the product of a large number of other random variables, it would make sense to select a lognormal distribution for testing. As another example, the exponential distribution would be a reasonable candidate if the stochastic variable represented a process akin to inter-arrival times of events that occur at a constant rate. As a final example, a gamma distribution would be a reasonable candidate if the random variable of interest were the sum of independent exponential random variables.

However, in most risk assessment projects, the uncertainties are not the result of underlying physical processes or mechanisms, or there are inadequate data available to use as a basis

[1] Technical Memorandum from Bob Ellis, Ellis Ecological Services, Inc., to Jay Lorenz, CH2M HILL. May 22, 2009. *Oregon LNG: Analysis of ESA-Listed Salmonid Entrainment at Ballast and Cooling Water Intakes.* Distributed to subgroup members May 22, 2009.

for selection of a particular distribution. In such cases, there are a few types of distributions that are used frequently because their parameters are easy to elicit from subject matter experts. For this analysis, all probabilistic variables were assigned one of two distributions: the triangle distribution and the uniform distribution. A brief discussion of each distribution follows.

Triangle Distribution

The triangle distribution specifies a triangular distribution using a midpoint (statistically, the mode, or the "base" estimate) and the upper and lower limits (endpoints) of the distribution. This distribution allows for skewness, where the upper bound is farther, typically, from the most likely outcome than the lower bound (that is, +50/-20). The following parameters have been specified for all triangle distributions:

- Lowest possible outcome
- Most likely outcome
- Highest possible outcome

In this analysis, triangle distributions are used to characterize the following variables:

1. Percentage of vessels annually that will be 148,000 cubic meters (m^3) capacity
2. Percentage of time slack water occurs
3. Percentage of fish south of Desdemona Sands
4. Percentage of fish in the top 20 feet (ft) of water
5. Percentage of fish that react to an entrainment threat at cruising speed (versus burst speed or sustained speed)
6. Fish lengths by species

Uniform Distribution

The continuous uniform distribution is such that all intervals of the same length between its endpoints are equally probable. The distribution is defined by a minimum and maximum value. In this analysis, the uniform distribution is used to characterize intake velocities at seachests in each of four potential capture zones.

Methodology Overview

Estimated fish entrainment by species is a function of a series of relationships between relevant variables, some of which are modeled as deterministic (single point estimates), and some of which are modeled as uncertain with a probability distribution. A flow diagram that shows the relationships between variables is shown in Figure 1. In the diagram, deterministic variables are shown as yellow squares, probabilistic variables are shown as green ovals, and calculated values are shown as blue, rounded squares.

Terminal Variables

The Terminal variables refer to data regarding the ships that will dock at the proposed Terminal. They include the number of annual deliveries, vessel size, hours of intake, intake velocities, and potential capture zones.

Terminal Operation

During the unloading process, the LNGCs will take on ballast water in order to offset the tonnage lost due to the LNG unloading process and to correct for any trim, list, or structural considerations. The intake of ballast water is necessary to maintain safe operations and to provide a constant freeboard between the vessel and the marine Terminal. Cooling water is also required to cool ship engines. Ballast and cooling water systems and requirements vary among vessels, including vessels of similar size and capacity.

Pertinent characteristics of LNGCs and LNG operations were gathered through contacts within the shipping industry and engine manufacturers, and from design data and photographs of the largest expected LNGC's seachests at the Daewoo Shipbuilding & Marine Engineering (DSME) Shipyard. Such data are often proprietary or closely held and are not typically shared outside the industry. Therefore, it was challenging to obtain accurate information on seachest design and configuration.

A single seachest is a recess or cavity in the ship's hull through which water is drawn for onboard uses (Figure 2). Different ship water systems (e.g., ballast water, cooling water, and fire suppression water) do not have individual seachests but, rather, the various water supplies obtain their water via intakes within shared seachests. Each seachest has one or several openings. A typical opening is 0.8 meter (m) (2.6 ft wide and 1.5 m (4.9 ft) high. It was assumed that each seachest is equipped with four of these openings, as was the case for the observed ship at the DSME Shipyard. Each opening is equipped with a grate or trash rack. Figure 1 illustrates a typical seachest with four grated openings. A typical grate consists of 2.5- to 5.0-millimeter (mm) (0.1- to 0.2-inch [in.])-wide bars, 25 mm (one in.) on center. Most LNGCs have a filter inboard of the seachest intake, consisting of a mesh with 5-mm (0.2-in.) openings. This mesh size is larger than the screening criterion of 2.38 mm (3/32 in.) recommended by the National Marine Fisheries Service (NMFS) and the Oregon Department of Fish and Wildlife (ODFW) for intakes where salmonid fry are present, and is less than the 6.35-mm (1/4-in.) screening criterion where fry are never present.

A typical ship will have four seachests—two "high" and two "low." The low seachests are located on either side of the keel, and it is assumed they will not be used when the LNGCs are docked in the Columbia River. This is because the seachests would be located so near the bottom of the river that there would be risk of entraining sediment. The high seachests are located on the lower part of the hull on either side (port and starboard), typically near the stern. The depth of the seachests relative to the water surface can vary, but because the ship must maintain a constant draft, the seachest depth is expected to remain relatively constant while the vessel is at dock. On the basis of industry sources, this depth is expected to be 27 to 35 ft below the water line, and for the purposes of this modeling, it was assumed to be 30 ft (9 m) deep. Water can be pumped through any of the seachests, as the various water systems have connections to each.

FIGURE 1
Methodology Flow Diagram

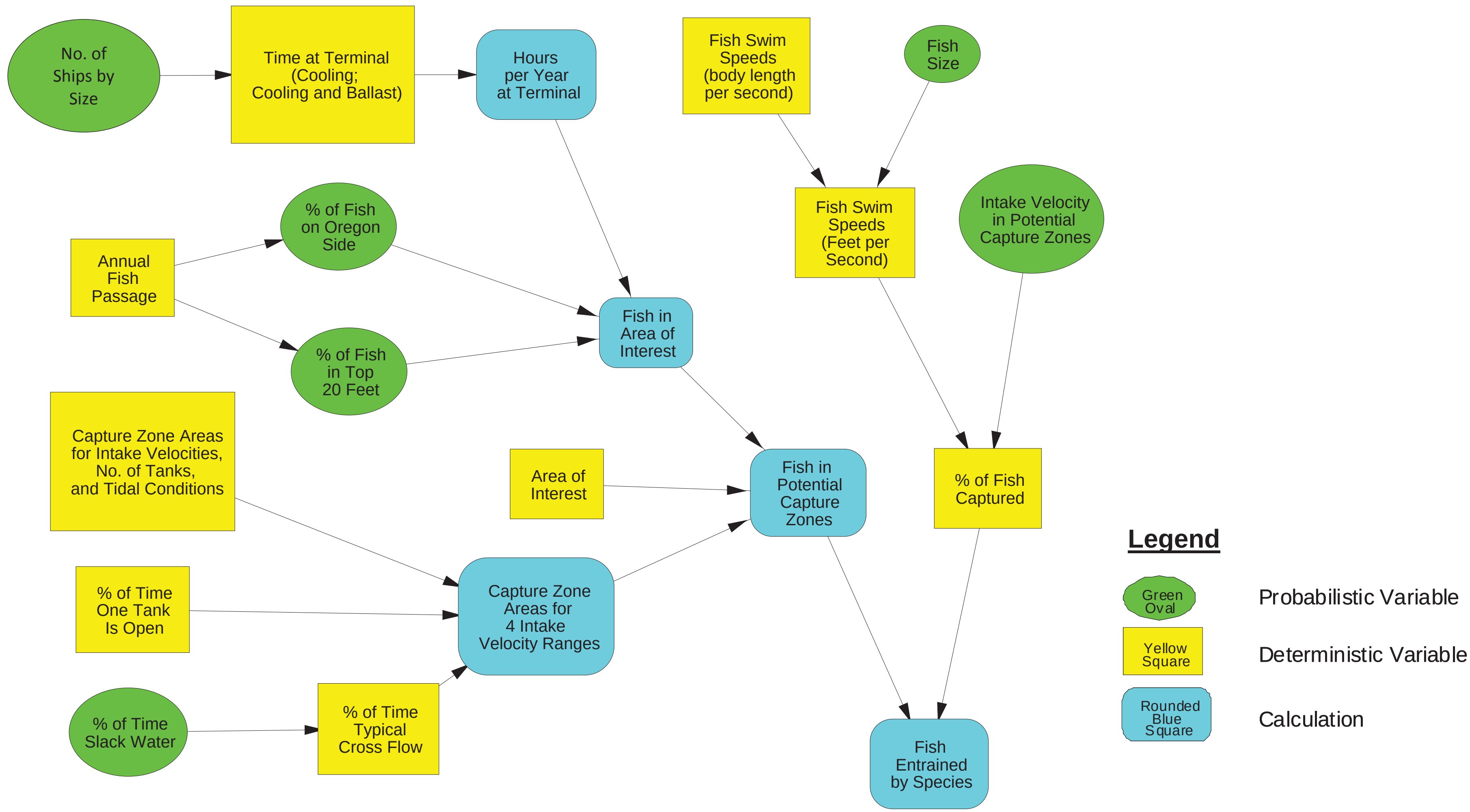
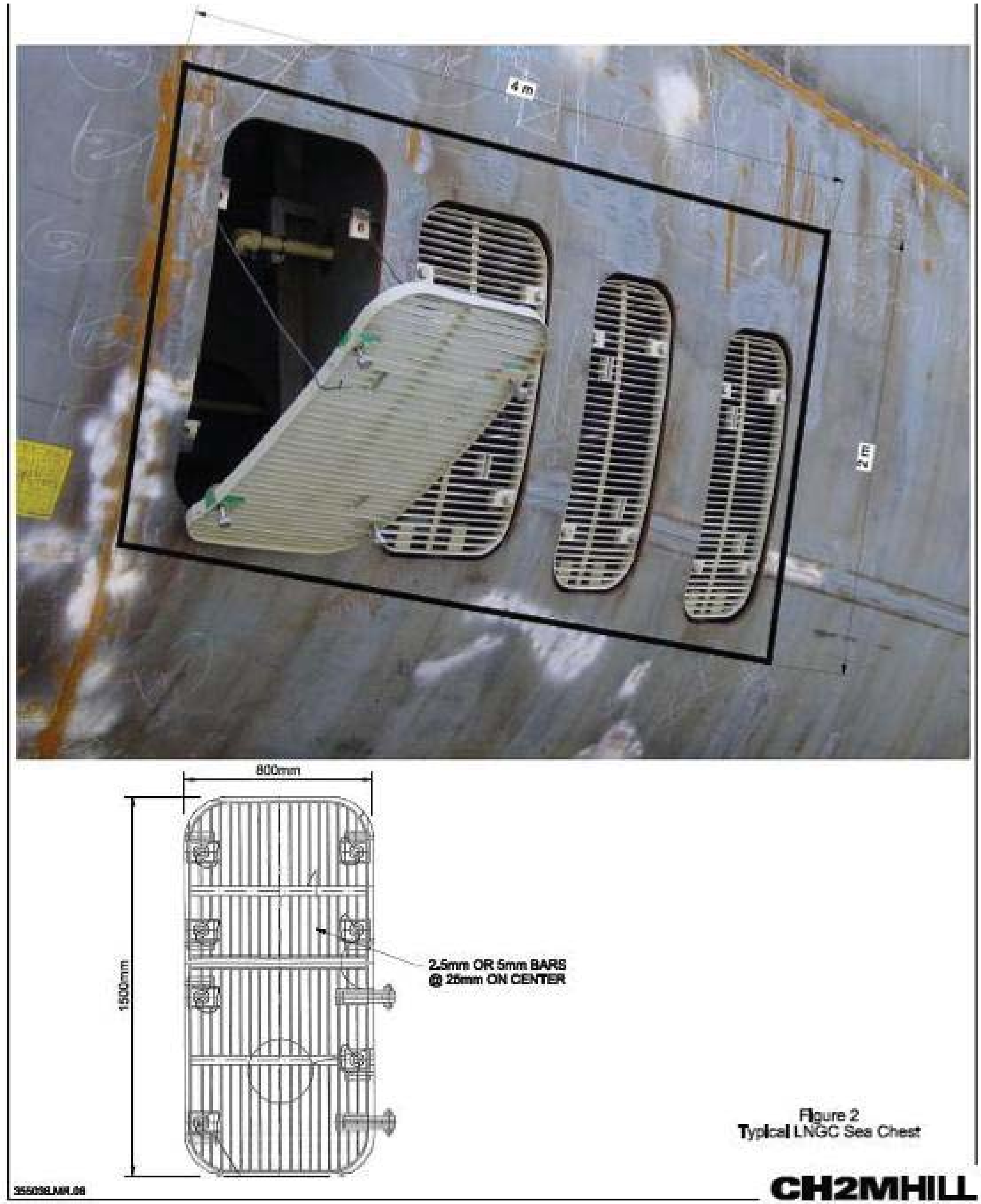


FIGURE 2
Typical Seachest, Photographed at the DSME Shipyard



The DSME Shipyard data indicate that although there is variability in the seachest configuration and flow rates, the operational principles are similar for most LNGCs. The DSME Shipyard provided typical ballast water requirements, seachest locations and opening sizes, operating parameters of ballast and cooling water intake, and cooling water requirements for three types of LNGCs: a common carrier of 148,000 m^3 capacity, a carrier of 213,000 m^3 capacity (Q-Flex Class), and a carrier of 266,000 m^3 capacity (Q-Max Class).

In general, most LNGCs under 150,000 m^3 are steam powered while many of the newer ships with capacities greater than 150,000 m^3 are diesel powered. Currently, most vessels in service throughout the world have capacities of 150,000 m^3 or less and are powered by steam. Diesel- and steam-powered vessels differ in the amount of cooling water required. A steam-powered vessel requires a large quantity of water to cool the condensers, even while the vessel is docked. Cooling water is also required for the ship's equipment (for example, generators), but at a much lower flow rate. A diesel-powered ship requires cooling water primarily for the ship's equipment; diesel-powered ships do not use condensers. Therefore, the quantity of water required is substantially less for larger diesel-powered ships.

Hours of Water Intake

LNGC vessels require cooling water at a constant rate for the entire time they are at port. The amount of time the vessels spend in port is dictated by two things: the unloading capacity of the Terminal, and unpredictable variables such as the amount of time it takes to complete paperwork or other administrative tasks. The amount of ballast water required depends on the size of the vessel; larger vessels require more ballast water to offset their cargo, and because the on-loading rate is constant, they must therefore spend more time unloading.

A typical steam-powered vessel will use a large pump rated at 10,000 m^3 per hour for the main condenser cooling water, and a smaller pump rated at 3,000 m^3 per hour for the ship's equipment. The total flow that is actually used is normally less than the maximum capacity of the pumps; total use is 1,090 m^3 per hour for main condenser cooling and 1,300 m^3 per hour for auxiliary equipment, or a total cooling-water flow rate of approximately 2,390 m^3 per hour. In comparison, the typical cooling-water requirements for the new diesel-powered vessels are expected to be approximately 2,040 m^3 per hour (i.e., 1,300 m^3 per hour for main condenser cooling and 740 m^3 per hour for auxiliary equipment).

For the purposes of modeling, it was assumed that each vessel would be in port for 21 hours. This was based on industry sources, including data obtained from Lone Star R.S. Platou Inc., a shipping company, which reported time at port for several vessels at several LNG terminals; and data for the Cove Point and Elba LNG terminals in Maryland and Georgia, respectively. Times at port for Lone Star R.S. Platou ships ranged from 4 hours, 14 minutes to 23 hours 15 minutes, with an average of 20 hours, 57 minutes. Time spent at port for ships at the Elba and Cove Point facilities ranged from 17 hours 40 minutes to 33 hours 32 minutes, with an average of 23 hours, 38 minutes and a median of 21 hours 57 minutes.

Of the 21 hours spent in port, the amount of time spent unloading is based on the unloading capacity of the Terminal. During this time, both ballast water and cooling water are required. For the remainder of the 21 hours, only cooling water will be withdrawn from the estuary. Table 1 shows the total water requirements for different vessel classes. Annual hours of water intake will then be calculated as follows:

Annual hours of water intake = (number of ships by class) * (hours at Terminal for each ship)

TABLE 1
LNGC Water Flow and Time at Terminal

	Water Flow (m^3 per hour)			Maximum Intake Rate (ft^3/sec)	Time at Terminal (hr)	
LNGC Class (cm)	**Ballast**	**Cooling**	**Ballast and Cooling**	**Ballast and Cooling**	**Cooling Only**	**Ballast and Cooling**
148,000	6,200	2,478	8,678	85.1	9	12
213,000	6,600	2,040	8,640	84.7	7	14
266,000	6,600	2,040	8,640	84.7	5	16

Note: Time at Terminal estimated for cooling water only and for ballast and cooling water combined.

Abbreviations:

m^3 = cubic millimeters.
ft^3/sec = cubic feet per second.
hr = hours.

The maximum intake rate was calculated for the "typical" seachest, with four openings 0.8 m (2.6 ft) wide and 1.5 m (4.9 ft) high. In the initial modeling (discussed in the May 22 memo), it was assumed that each of the 100 vessels per year would be withdrawing water at the maximum flow rate (85 cubic feet per second [ft^3/sec]) for 20 hours. In the updated modeling, intake velocities around the seachests were calculated for each condition (cooling and ballast plus cooling), and incorporated the expected proportion of different ship types and the amount of time each ship type spends withdrawing water.

Annual Deliveries

In order to determine the amount of water withdrawn annually, it is necessary to estimate how many of each vessel class will call at the Terminal each year (because the different vessel classes have different water requirements). When the Terminal is operating at design capacity, it is assumed that 100 vessels will arrive at the Terminal annually. This reflects the annual capacity of the Terminal. In initial years, fewer vessels are anticipated; therefore, the amount of salmonid entrainment estimated in this memorandum is the maximum expected during full Terminal operation.

According to Oregon LNG representatives, most ships delivering LNG to the Terminal, at least initially, will be the smaller, steam-powered vessels, with fewer Q-Flex and fewer still Q-Max class vessels. Oregon LNG representatives believe that the most likely proportion of ship sizes that will call at the Terminal is as follows:

- 148,000 m^3—45 ships per year
- 213,000 m^3—35 ships per year
- 266,000 m^3—20 ships per year

Because the number of ships in each class will vary from year to year, and because the number of each class that will call at the Terminal is unknown, this variable was modeled using a triangle distribution. Oregon LNG representatives estimate that the 148,000-m^3 vessels will be the most common, and that the proportion of this vessel size will vary according to a triangle distribution, as shown in Table 2.

TABLE 2
Likelihood That Vessels Will Be 148,000 m^3 in Size

Lowest Possible	Most Likely	Highest Possible
0%	45%	100%

During the Monte Carlo simulation process, the ratio of vessels arriving in each class in the most likely scenario is used to determine the number of vessels in each class under all other scenarios. In other words, in each simulation the number of 148,000-m^3 vessels is selected from the triangle distribution, and 100 minus that number of vessels (the remainder) is allocated as follows: the number of 213,000-m^3 vessels is 35/55 (64 percent) of the remainder, and the number of 266,000-m^3 vessels is 20/55 (36 percent) of the remainder. An example of this method is shown in Table 3.

TABLE 3
Ship Size Distribution in Four Example Model Iterations

	148,000-m^3 Vessels	Remainder	213,000-m^3 Vessels	266,000-m^3 Vessels
Most likely	45	55	35	20
Iteration 2	52	48	31	17
Iteration 3	41	59	38	21
Iteration n	68	32	20	12

In the initial modeling (discussed in the May 22 memo), the variability in ship sizes and water needs was not captured. Instead, 100 vessels per year were assumed to withdraw water at the maximum rate (85 ft^3/sec) for 20 hours.

Intake Velocities

To estimate the potential for entrainment, it is necessary to know the shape and size of the area around the seachest where intake velocities exceed the swimming abilities of various fish. A velocity of 0.4 foot per second (ft/sec) was set as the lower limit for the area of potential entrainment because 0.4 ft/sec is the approach velocity set by NMFS as safe for salmonid fry at screens with automated cleaning.

Coast and Harbor Engineering completed hydrodynamic modeling to determine intake velocities around the seachests during both cooling water withdrawal and ballast + cooling water withdrawal.

Modeling was conducted with nonhydrostatic, three-dimensional (3-D), hydrodynamic modeling code. The model is based on the 3D Reynolds Averaged Navier-Stokes (RANS) equations and the Boussinesq approximation (Kanarska and Maderich, 2003). The model equations are integrated with mode-splitting technique and decomposition of pressure and velocity fields on hydrostatic and nonhydrostatic components. The model has been tested with experimental data and proved to be a reasonable tool for engineering analysis of flow hydrodynamics at intakes and jets.

The modeling domain was set up to be large enough that the flows on the far ends of the domain were not affected by the intake velocities. Ambient flows were included in the model as constant initial- and boundary-condition velocities with speed 1.64 ft/sec (0.5 meter per second [m/sec]). Figure 3 illustrates the expected intake velocities at the seachest and at varying distances from the ship's hull under slackwater conditions, looking from the stern toward the bow, with the riverbed illustrated in red at the bottom of the figure. Figure 4 is a plan view, looking down, with the four seachest openings illustrated from bow to stern.

FIGURE 3
Intake Velocities at the Seachest

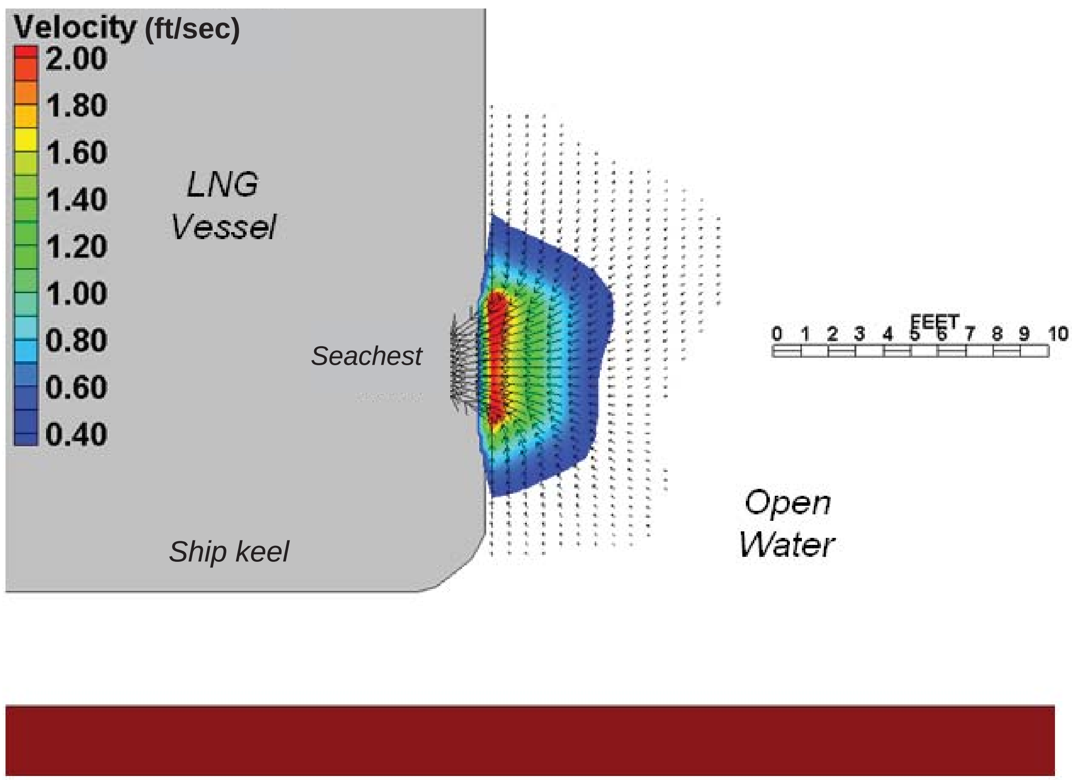
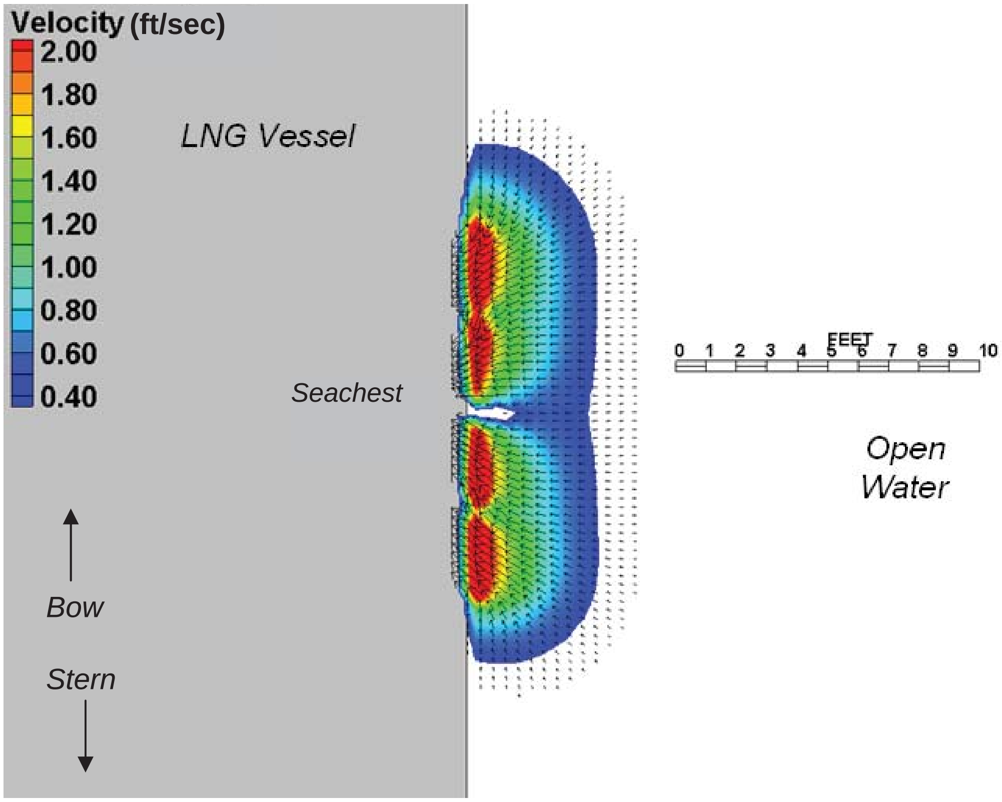


FIGURE 4
Intake Velocities at the Seachest, Plan View



As can be seen, the zone of influence, where intake velocities exceed 0.4 ft/sec, extends approximately 5 ft out from the ship's hull, and the maximum intake velocity at the face of the seachest will be 2.2 ft/sec. Modeling indicated that under tidal or riverine cross-flow conditions of 1.64 ft/sec (which would be average cross flow), the zone of influence was smaller and maximum velocities at the face of the seachest were less (Figure 5).

Because Terminal unloading capacity dictates the rate at which water is required, the velocity at the seachests is the same, regardless of ship size (provided that the seachests have the same dimensions). Only the time of water withdrawal differs among vessel types.

Potential Capture Zones

In order to calculate entrainment, it is necessary to know the total area around the seachest through which a fish could potentially swim that has velocities above its swimming ability (discussed below in the section titled Fish Variables). For modeling purposes, four potential "capture zones" were defined around the seachests. These zones were established somewhat arbitrarily, with the zone of highest velocity (zone 1) containing a range of 0.6 ft/sec, while the remaining zones each contain a range of 0.4 ft/sec. Table 4 illustrates the range of velocities within each of the capture zones. Velocities within each zone were assumed to be a uniform distribution within the ranges.

FIGURE 5
Change in Intake Velocities at the Seachest under Cross-flow Conditions of 1.64 ft/sec

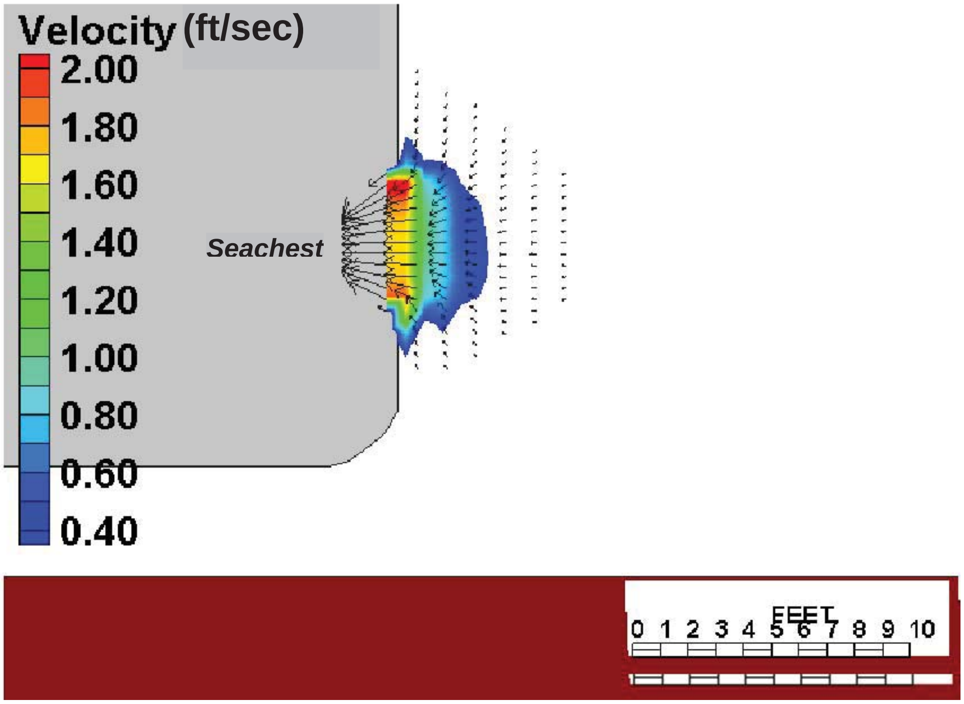


TABLE 4
Intake Velocities in Each Capture Zone

	Velocity in Feet per Second			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Low	1.6	1.2	0.8	0.4
High	2.2	1.6	1.2	0.8

In the initial modeling (reported in the May 22 memo), only two capture zones were used. Zone A had velocities from 0.66 to 2.2 ft/sec, and Zone B had velocities from 0.4 to 0.66 ft/sec. The probabilistic modeling (discussed herein) further differs from the initial modeling in two important ways: the number of seachests assumed to be in operation, and the influence of tidal cross flow. These factors were not captured in the initial modeling; instead, cross flow was considered to be nonexistent and only one seachest was assumed to be in operation at all times. Neither of these scenarios represents typical conditions; in fact, Oregon LNG has stated that it will require LNGCs to use two seachests (both of the high seachests, one on either side of the ship) unless there is a compelling reason to do otherwise.

To address these issues, Coast and Harbor Engineering completed multiple modeling runs and calculated the area within each capture zone under each scenario. Capture zone areas are the two-dimensional areas corresponding to the velocities of each zone as defined in Table 4, above, and are reported in Table 5.

TABLE 5
Potential Capture Zone Areas Under Eight Different Modeled Scenarios

	Capture Zone (square feet)			
	Zone 1	Zone 2	Zone 3	Zone 4
Capture Zone Area – Cooling and Ballast				
Slack Water				
One seachest open	4.2	4.4	7.4	23.0
Two seachests open	0.0	0.0	4.2	11.7
Typical cross flow of 1.64 feet per second (ft/sec)				
One seachest open	0.0	0.0	1.4	5.6
Two seachests open	0.0	0.0	0.0	0.1
Capture Zone Area – Cooling Water Only				
Slack Water				
One seachest open	0.0	0.0	0.0	6.5
Two seachests open	0.0	0.0	0.0	0.0
Typical cross flow of 1.64 ft/sec				
One seachest open	0.0	0.0	0.0	0.0
Two seachests open	0.0	0.0	0.0	0.0

NOTE: Based on modeling by Coast and Harbor Engineering.

Additional assumptions included in the model were as follows:

- Two seachests will operate 90 percent of the time. According to Oregon LNG, it is standard industry practice to use both seachests for cooling and ballast water intake. The only time that a single seachest is open is when some type of malfunction or other unusual event occurs.
- The percentage of time with slack water vs. typical cross flow was defined as a triangle distribution (discussed below in the section titled River Variables).

As can be seen in Table 5, during cooling-water-only withdrawal, only the lowest velocity zone is present, and then only when one seachest is in operation under slackwater conditions. At all other times, velocities in excess of 0.4 ft/sec do not occur, even at the face of the seachest. Therefore, except under very rare conditions involving slack water, atypical seachest operation, and very small fish, no entrainment will occur during cooling-water-only withdrawal.

River Variables

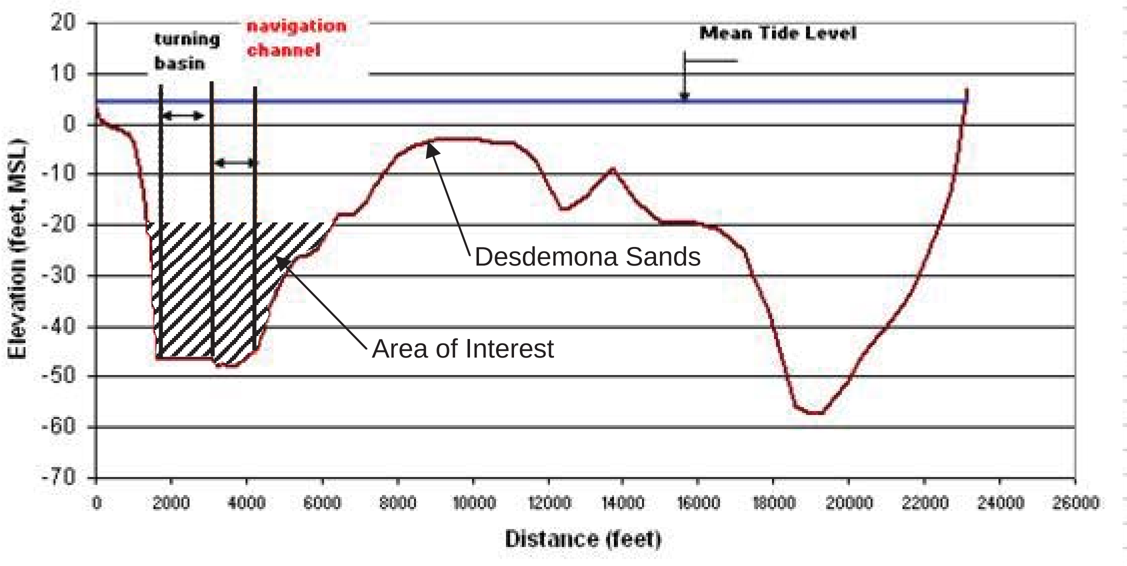
There are several uncertain variables related to the river that affect the potential for fish entrainment. The river variables considered in the model include the size of the "Area of Interest" and tidal or riverine cross-flow conditions.

Area of Interest

Each fish in the LCRE was assumed to pass once through a two-dimensional plane extending from the water surface to the riverbed (top to bottom) and from the Oregon to the Washington shore (north to south). The total area of this plane in the LCRE is 51,422 square meters (m^2) (553,500 square feet [ft^2]) at an average tidal stage (Mean Tide Level). Fish are likely to be entrained only within a small portion of this plane in the immediate vicinity of the seachests. The area where fish are susceptible to entrainment is termed the "Area of Interest." In the initial modeling, fish were assumed to be uniformly distributed in both the horizontal and vertical planes.

For the purposes of probabilistic modeling, fish were distributed horizontally on either side of Desdemona Sands and vertically within the water column, as discussed below. On the basis of available data, it was assumed that most fish occur in water less than 20 ft deep, and any fish that do occur below the 20-ft depth would be uniformly distributed. Therefore, the Area of Interest is that portion of the LCRE greater than 20 ft in depth, between the Oregon shore and Desdemona Sands. The size of the Area of Interest is approximately 114,125 ft^2 (10,602 m^2) (Figure 6). Any fish occurring above this depth or on the north side of Desdemona Sands would not be susceptible to entrainment.

FIGURE 6
"Area of Interest" in the LCRE



The area of the four capture zones under each of the eight modeled scenarios (Table 5) was divided by the total Area of Interest to determine the percentage of the total area occupied by each of the four zones under each scenario. This percentage was used in later calculations.

River Flow Conditions

River cross flow influences the size of the capture zones, as discussed above. Therefore, it is necessary to estimate the amount of time that there is slack water versus the amount of time with cross flow. Slack water occurs only as the tide switches from flood to ebb (four times each day for brief periods), or when the river flow equals the incoming tidal flow. Because tidal and river outflow conditions vary, the amount of time with slack water annually was assumed to follow a triangle distribution, shown in Table 6.

TABLE 6
Percent of Time Slack Water Occurs

Lowest Possible	Most Likely Condition	Highest Possible
10%	20%	30%

While cross-flow velocities are highly variable, for the purposes of this analysis typical cross-flow conditions are assumed to be 1.64 ft/sec and to vary probabilistically along with slack water. In other words, the amount of time that typical cross-flow conditions occur is calculated as 1—the percentage of time that slack water occurs (as calculated by the triangle distribution).

Fish Variables

Fish variables considered in the analysis include salmonid abundance, seasonal occurrence, horizontal and vertical distribution, size/swimming speed, and behavioral responses to the threat of entrainment.

Salmonid Abundance

Salmonid abundance estimates were obtained from Ferguson (2006, 2007, and 2009). These documents provide abundance data under two scenarios: “transportation with spill,” where some juvenile salmonids are transported around the dams and some pass through, and “full transportation,” where all juvenile salmonids are assumed to be transported around the dams. Population numbers for the “transportation with spill” scenario are slightly lower (for example, 2 percent lower for subyearling Chinook) because of mortality of fish passing over the dams. However, according to Mr. Randy Absolon of NMFS, the most appropriate data to use are the transportation with spill data, because that is the typical scenario experienced by fish in the Columbia River (Absolon, 2009).

The population data obtained from Ferguson (2006, 2007, and 2009) are for juvenile fish at Tongue Point. These estimates do not include fish from populations downstream of Tongue Point that could potentially be affected by the proposed Project, and there are no reliable data on the numbers of fish this may include. The primary population of fish downstream of Tongue Point is present in the Youngs Bay drainage, including Youngs River and its tributaries (primarily the Klaskanine River and its branches) and the Lewis and Clark River. Significant hatchery releases occur in Youngs Bay and in the Youngs and Klaskanine rivers; for example, in 2008, 1.3 million coho, 1.25 million fall Chinook, 543,000 spring Chinook, and 41,000 winter steelhead were released (ODFW, 2009). However, winter steelhead in Youngs Bay belong to the Southwest (SW) Washington ESU, which is not ESA listed; and the spring and fall Chinook that are released into the system include fall Chinook stock 52 (also called the “Rogue” stock) and spring Chinook stocks 22 and 24, none of which are part of any ESA-listed ESU (ODFW and CEDC, 2005a and b). Most of the hatchery Chinook are raised in the Youngs Bay net pens for the Select Area Fishery, with smaller numbers released into the Klaskanine River and tidewater sections of Youngs River. Any entrainment of these unlisted salmonid juveniles could potentially have an impact on recreational and commercial fisheries.

Coho released into the system belong to hatchery stocks 14 and 11, both of which are included in the listing for Lower Columbia River [LCR] coho (ODFW and CEDC, 2005c). However, the vast majority of the releases occur from the Youngs Bay net pens for the Select Area Commercial and Recreational Fisheries (those not released to the net pens include small numbers distributed to area high schools for educational purposes). This stock is heavily harvested upon its return (with a 98 percent harvest rate for the 1993 to 1997 broods) and the goal is for no spawning escapement, as any hatchery strays that spawn successfully would compete with the few native fish that may be present (ODFW and CEDC, 2005c). Therefore, although there is a small chance that listed LCR coho hatchery releases could be entrained, any entrainment would not reduce the future reproductive potential of the population (because all listed hatchery releases are targeted for harvest) and, therefore, would have no effect on species recovery. Because the population is small, and smolt-to-adult survival is likewise small, entrainment of juveniles from the Youngs Bay population would not affect recreational or commercial harvest (for comparative purposes, entrainment losses from the entire population of more than 13 million LCR coho would result in the estimated loss of only three fish to the fishery).

Further, natural reproduction in the Youngs Bay drainage is effectively nonexistent for both coho and Chinook, except for hatchery-origin strays. ODFW and CEDC (2005c) state that no wild LCR fall Chinook spawners were observed in LCR tributaries (which include the Youngs and Lewis and Clark rivers) from 1998 to 2005, and that all of the spawning that did occur was from unlisted hatchery stocks. Therefore, the number of listed LCR Chinook produced below Tongue Point that could be potentially affected by the proposed Project is very small to nonexistent.

ODFW has expressed concern about the impact in the future if populations were to increase. According to the *Lower Columbia River Salmon Recovery and Fish and Wildlife Subbasin Plan*, the population of fall Chinook in Youngs Bay is considered to be a “stabilizing” population (LCRFRB, 2004), meaning that it is likely to be maintained at its current low level in the future rather than increased significantly. This is because of the multiple challenges faced by the population, which make its recovery of low priority. This plan was completed by Washington state agencies and does not necessarily represent the final opinions of ODFW, but it was completed in consultation with ODFW. Because ODFW population recovery plans have not been completed, this estimate of future reproductive potential is the only estimate available. Because the population is effectively zero and is not expected to increase, the entrainment potential of this population is also effectively zero now and in the future.

In regard to Youngs Bay coho, McElhaney et al. (2007) state that “the [Youngs Bay] population [of coho] is dominated by hatchery fish, with on average at least 80 percent of the coho of hatchery origin…these data indicate little, if any natural productivity of coho in the Youngs Bay population and we consider the population most likely in the “extirpated or nearly so” or “high risk” category.” The *2005 Native Fish Status Report* (ODFW, 2005) states that “it is likely that a large portion of [LCR coho] returns over the past 30 years have been hatchery origin…Hatchery fractions since 1999 have ranged from 49 to 99 percent." Spawner density per mile of spawning habitat in the Youngs Bay basin from 2000 to 2003 ranged from 17 to 231 (ODFW, 2005). Combining the spawning density and the percent hatchery origin numbers from ODFW (2005) yields from 0.17 to 71.4 natural-origin spawners per mile, with a mean over the 4 years of 29.1. Suring et al. (2006) state that from 2002 to 2004, the estimated wild-origin spawning population ranged from 142 to 281 with a mean of 213 for the entire Astoria population, which includes the Youngs and Lewis and Clark rivers and numerous tributaries upstream of Tongue Point (which would have been included in the NMFS population estimates). This suggests that the total number of spawners contributing ESA-listed coho smolts that were not included in the NMFS population estimates used for the modeling is something less than 200 adult fish. Assuming 200 spawners (half of which are female), fecundity of 2,878 eggs per spawner, and egg-smolt survival of 0.018 (Quinn, 2005) yields 5,180 smolts. As with fall Chinook, coho in the Youngs Bay basin are considered to be a "stabilizing" population in the *Lower Columbia River Salmon Recovery and Fish and Wildlife Subbasin Plan* (LCRFRB, 2004), and the population is therefore unlikely to increase in the future. Thus, the Youngs Bay population was assumed to consist of 5,180 smolts annually in the subsequent modeling.

Tables 7 and 8 contain total fish populations used in the modeling, and the percentage of each population that is ESA listed. The 3-year population means were used in subsequent calculations.

TABLE 7
Total Juvenile Salmonid Population at Tongue Point

Total	2006	2007	2008	3-year Mean
Chinook yearling	38,832,655	28,719,701	29,538,756	32,363,704
Chinook subyearling	89,791,172	90,003,337	81,742,198	87,178,902
Sockeye	1,368,440	1,663,764	1,650,027	1,560,744
Coho	18,360,241	16,883,265	18,579,800	17,941,102
Chum	1,607,982	1,452,982	1,342,982	1,467,982
Steelhead	14,278,819	13,922,277	14,046,231	14,082,442

TABLE 8
Percentage of the Total Juvenile Population at Tongue Point That Is ESA Listed

Species	Status	2006	2007	2008	3-year Mean
Spring/Summer Chinook yearling	Wild	26.55	11.28	13.91	17.25
	Ad-clip*	6.04	6.85	6.26	6.38
	No ad-clip*	0.76	2.43	1.98	1.72
Fall Chinook yearling	Ad-clip*	1.27	1.14	1.09	1.17
	No ad-clip*	0.43	1.41	1.20	1.01
Chinook subyearling	Wild	26.59	26.20	30.18	27.66

TABLE 8
Percentage of the Total Juvenile Population at Tongue Point That Is ESA Listed

Species	Status	2006	2007	2008	3-year Mean
	Ad-clip*	26.01	41.38	46.33	37.91
	No ad-clip*	18.91	1.11	0.86	6.96
Sockeye	Wild and hatchery	2.73	4.58	6.60	4.64
Coho	Wild	6.53	7.10	6.40	6.68
	Ad-clip*	54.85	52.98	55.86	54.56
	No ad-clip*	7.93	22.71	8.05	12.90
Chum		100	100	100	100.00
Steelhead	Wild	19.5	18.86	15.77	18.04
	Ad-clip*	22.98	19.77	21.87	21.54
	No ad-clip*	4.7	5.35	5.47	5.17

Note:
* Ad-clip = adipose-fin-clipped hatchery fish; no-ad-clip = non-adipose-fin-clipped hatchery fish.

Ferguson (2006, 2007, and 2009) also provides percentages of the ESA-listed fish that belong to each ESU/DPS. Table 9 provides the 3-year mean for the percentage of the total listed fish that belong to each ESU.

TABLE 9
Percentage of the Total ESA-listed Juvenile Salmonids That Belong to Each ESU/DPS

Evolutionarily Significant Unit/Distinct Population Segment (ESU/DPS)	% of the Listed Wild Fish in Each ESU	% of the Listed Ad-clipped Fish in Each ESU	% of the Listed Non-ad-clipped Fish in Each ESU
Yearling Chinook			
Snake River spring/summer	13.21	16.63	14.39
Snake River fall	0.00	3.59	24.27
Upper Columbia River	5.34	2.83	26.97
Lower Columbia River Spring	24.89	22.10	25.01
Upper Willamette River	56.56	54.87	9.37
Subyearling Chinook			
Snake River fall	0.66	2.25	25.41
Lower Columbia River tule	77.28	97.75	74.59
Lower Columbia River late run	22.06	0.00	0.00
Steelhead			
Snake River	29.03	61.88	60.03
Upper Columbia River	4.98	7.61	21.09
Middle Columbia River summer	25.90	7.26	5.28

TABLE 9
Percentage of the Total ESA-listed Juvenile Salmonids That Belong to Each ESU/DPS

Evolutionarily Significant Unit/Distinct Population Segment (ESU/DPS)	% of the Listed Wild Fish in Each ESU	% of the Listed Ad-clipped Fish in Each ESU	% of the Listed Non-ad-clipped Fish in Each ESU
Middle Columbia River winter	3.44	0.00	0.00
Lower Columbia River summer	2.88	0.00	0.00
Lower Columbia River winter	23.49	23.24	13.60
Upper Willamette River	10.96	0.00	0.00
Sockeye			
Snake River sockeye	100		
Coho			
Lower Columbia River coho	100	100	100

Seasonal Abundance

In the initial modeling effort, the number of fish passing the Terminal each hour was calculated for each species. With the exception of subyearling Chinook, this estimate was based on the 3-year mean population and the 5-year mean of daily passage at Bonneville Dam. In the case of subyearling Chinook, the population was divided into an upriver component (which is produced above Bonneville Dam) and a lower river component. Hourly passage rates were calculated for the upriver population based on Bonneville Dam daily passage data. For the lower river population, hourly passage was based on a seasonal abundance curve constructed from data in Bottom et al. (2008).

Once the hourly passage rate was calculated, it was then necessary to determine the number of fish passing through the LCRE during those hours when ships are at berth. It was assumed that ships would be withdrawing water for 20 hours and that two ships would arrive per week. A matrix was developed that multiplied the hourly fish passage through the LCRE on any given day by the number of hours that a ship was at port during that day. Ship arrivals were staggered throughout the year at 3- to 4-day intervals, and numerous runs were completed such that a ship was present during each calendar day. The simulation was run only for those periods of the year when fish of each species would be expected in the LCRE. The runs were then averaged to obtain the mean number of fish passing through the LCRE while the ships were at port in an average year. The number of fish passing through the LCRE was then multiplied by the percentage of the LCRE cross-section occupied by the capture zone, to obtain the total “entrainable” population of each species (this number was then further reduced by subtracting out unlisted salmonids and those fish that could escape, based on swimming ability).

A much simpler calculation for the number of fish potentially entrained, which ignores seasonality, is to simply take the total annual population of any given species multiplied by the percentage of time (in a given year) that ships are withdrawing water (22.8 percent of the year, assuming 100 ships withdrawing water for 20 hours), times the percentage of the

LCRE cross-section occupied by each capture zone (as defined in the initial model). This simplified method ignores the influence of daily fluctuations in fish populations, but it yields estimates that are, in all cases, within one percent of those obtained by the more complicated seasonal curve calculation method. Therefore, the simpler method was used for the probabilistic model.

Fish Distribution

Both horizontal distribution and vertical distribution are important in estimating susceptibility to entrainment. In the initial model, fish were assumed to be evenly distributed both horizontally and vertically, except for chum (which were assumed to be more prevalent on the Washington side and to reside only in the top 20 ft of the water column) and subyearling Chinook (95 percent of which were assumed to be in the top 20 ft of the water column, above seachest depths). Although data are limited, the assumption of equal horizontal and vertical distribution is overly conservative.

Horizontal

Unlike the initial modeling effort, the LCRE was divided at approximately the midpoint of Desdemona Sands, which are exposed at low tide, and the fish were distributed either to their north or south. McComas et al. (2007 and 2008) studied acoustic-tagged yearling and subyearling Chinook at the mouth of the Columbia River, and found significantly more fish on the Washington side of the navigation channel than on the Oregon side, and very few fish within and immediately adjacent to the navigation channel itself. These distribution results may not be the same as fish distribution at the Terminal location, in that the tracking array was located more than 5 miles downstream of the Terminal at river mile (RM) 5.6; but 2 years of data did not illustrate any concentrations of fish near the Oregon shore.

Truelove (2005) also tracked salmonids in the LCRE by releasing more than 2,600 radio-tagged, barged and run-of-river steelhead, yearling, and subyearling Chinook. Of these, 62 were actively tracked for 2 to 26 hours through the LCRE, from approximately RM 27 downstream to approximately RM 8 (no individual fish was tracked over the entire distance). The author found that all tracked salmon spent a portion of their migration in the main navigation channel, while a majority moved from the navigation channel through numerous shallow side channels, and into the deep northern channel, near the Washington shore. Some steelhead and one spring/summer (yearling) Chinook used the shipping channel adjacent to the Terminal, but the majority of the fall (subyearling) Chinook were distributed nearer the Washington shore, and none were tracked past the Terminal.

A recently published study (Carter et al., 2009) found that at RM 5.2 (East Sand Island), most acoustic-tagged yearling and subyearling Chinook salmon migrated on the north (Washington) side of the navigation channel. This was especially pronounced for subyearling Chinook salmon. No data from nearer the Terminal location were available, but the acoustic array at RM 5.2 is only 5.8 river miles downstream. With only 2 years of data (2005 and 2008), no clear pattern in cross-channel distribution was observed for acoustic-tagged steelhead on the array near East Sand Island.

Migration distribution across the array on the Columbia River Bar (RM 1.75) tended to be nearer, or in, the navigation channel than it was at RM 5.2 for yearling and subyearling Chinook salmon and steelhead.

In the case of chum salmon, except for some spawning on the Oregon side of the Columbia mainstem near McCord Creek (Multnomah Falls), all Lower Columbia chum are spawned on the north side of the Columbia mainstem and in Washington tributaries. On the basis of their spawning locations and their propensity to hug the shoreline, chum salmon likely migrate and rear primarily along the Washington shore. This is supported by the findings of Roegner et al. (2004a and 2004b). In 2003, the authors collected 284 chum salmon by beach seine, but only 39 of these were collected at Point Adams Beach (on the Oregon shore); the majority (166) were collected at West Sand Island on the Washington side of the estuary near the mouth, despite similar seining effort on each side of the river. In 2002, the authors collected 590 total chum salmon, but only four of these were collected on the Oregon side. Thus, it appears that the majority of chum salmon fry would be nearer the Washington shore.

On the basis of the findings discussed above, the occurrence of juvenile salmonids across the estuary was represented by a triangle distribution, with between 20 and 50 percent of the juvenile salmonids migrating through the LCRE between Desdemona Sands and the Oregon shore; 40 percent occurrence on the Oregon side is considered most probable.

Vertical

The available evidence indicates that juvenile salmonids tend to migrate in shallow surface waters. This assumption is supported, in part, by the significant predation of juvenile salmonids by Caspian terns, suggesting that many (if not most) juvenile salmonids are very near the surface because Caspian terns cannot dive deeper than 2.5 ft (Collis et al., 2001).

Ocean-type Salmonids (Subyearling Chinook and Chum). Chum salmon collected during beach seining at Point Adams Beach in 2002 and 2003—located at RM 8 downstream from the Terminal site—ranged in length from 30 to 75 mm, with the largest of those captured later in the year (May versus February) (Roegner et al., 2004a and 2004b). Because of their small size, chum likely avoid deep water; in fact, chum fry have been found to follow the shoreline in shallow-water areas until they reach 55 to 60 mm fork length or longer (Bax et al., 1980; Salo, 1981). The shallow-water orientation of juvenile chum is supported by numerous studies identifying chum salmon in shallow-water habitats (Levy and Northcote, 1981; Myers and Horton, 1982; Simenstad et al., 1982; Levings et al., 1986; Pearcy et al., 1989). It was recently reinforced by Toft et al. (2004), who found that juvenile salmonids (chum, Chinook, and coho) in Puget Sound were never observed in the lower part of the water column during 442 snorkel surveys, except for one observation of a larger Chinook or coho.

In deeper water habitats (up to 4.4 m deep), Toft et al. (2004) found that juvenile salmonids occupied the middle (40 percent of observed fish) to the surface (60 percent of observed fish) of the water column. Juvenile Chinook and coho were located more at the surface of the water column at deep-riprap sites, perhaps because of the underlying riprap structure and associated predators that can hide in the interstitial spaces. At other studied habitat types (cobble beach, sand beach, and shallow riprap), juvenile salmonids were more distributed between the middle and the surface of the water column. Chum were always observed at the surface except adjacent to overwater structures, where they were occasionally observed in the middle of the water column (up to 1.5 m [5 ft] deep). However, the study was conducted in Puget Sound and its applicability to the LCRE is unknown.

Chum salmon are also known to school (Simenstad et al., 1999), leading to a clumped distribution that further complicates attempts to estimate their entrainment risk. Nonetheless, there is no reason to believe that schooling would occur at the depth and in the location of the seachests. Therefore, it was assumed that because of their strong association with shallow shoreline habitats and distribution primarily along the Washington shore, chum fry would not be susceptible to entrainment/impingement at the Terminal site, which is located in deep water 2,100 ft offshore on the Oregon side of the Columbia River.

Like chum, subyearling Chinook prefer peripheral shoreline areas, wetlands/marshes, and shallow, protected sand flats or mud flats (Nightingale and Simenstad, 2001; NMFS, 2002; Fresh et al., 2003). Bottom et al. (2005) assumed (when conducting habitat opportunity simulations) that subyearlings were primarily located near shore in water ranging from 10 centimeters (cm) to about 2 m (4 in. to 6.5 ft) deep. As subyearlings grow, they move into other habitats and can be found in open-water areas. However, in open water they appear to still use the upper portion of the water column, with very few occurring below 20 ft in depth (Dawley et al., 1986; NMFS, 2006).

If subyearling Chinook move offshore, at least 95 percent of fry and fingerlings occur in the upper 3 m of the water column. This is illustrated by Dawley et al. (1986), who sampled fish at three depths in the Columbia River estuary (see Table 10). Ten trawls were conducted at each of three sites at each of three depths (or thirty trawls at each site) between June 1 and July 31, 1966. Although the data are more than 40 years old, there is no reason to believe that salmonids have altered their migration depths in that interval. No more than 4.8 percent of subyearling Chinook were collected below 3 m (9.84 ft—well above the depth of the seachests) (Table 10). And, more significantly, no more than 0.3 percent of subyearling Chinook were found below 19.68 ft in depth. On the basis of these results, it is assumed that 5 percent of the subyearling Chinook are present at seachest depths and therefore susceptible to entrainment. This is a conservative assumption given that no more than 0.3 percent of subyearling Chinook were collected by Dawley et al. (1986) at seachest depths.

TABLE 10
Number and Percentage of Subyearling Chinook Collected at Three Sites and Three Depths by Dawley et al. (1986)

	Jones Beach		Tongue Point		Clatsop Spit	
Fishing Depth	**No. of Fish**	**%**	**No. of Fish**	**%**	**No. of Fish**	**%**
0 to 9.84 ft	1,510	96.3	662	95.2	321	97.9
9.84 to 19.68 ft	57	3.6	33	4.8	6	1.8
Below 19.68 ft	1	0.1	0	0.0	1	0.3

Juvenile salmonids are distributed along a habitat continuum, with larger juveniles inhabiting deeper water (Bottom et al., 2005). Even among subyearlings, the larger individuals are found in relatively deeper water (Bottom et al., 1984). Dawley et al. (1986) found that subyearling Chinook captured in the water column with purse seines were generally 10 to 20 mm longer than those captured in nearshore habitats with beach seines. Therefore, smaller subyearlings originating below Bonneville Dam would likely be found only in the shallows, while larger subyearlings would be among the small percentage at seachest depths, further reducing their susceptibility to entrainment (because of greater swimming ability).

Recent data in Carter et al. (2009) indicate that migration depth may be more variable than previously assumed, and some subyearling salmonids were tracked migrating at depths of up to 90 ft. However, the data reported are preliminary, the study methods were not discussed, and—most critical to this modeling effort—the proportion of fish migrating at different depths was not provided.

Stream-type Salmonids (Yearling Chinook, Coho, Sockeye, and Steelhead). Information is generally lacking on vertical distribution of stream-type salmonids in the Columbia River estuary. Most of the available evidence indicates that the majority of stream-type juveniles move rapidly downstream through the estuary and are located in the upper portion of the water column (Johnson et al., 2003; Emmett et al., 2004; Truelove, 2005; Dauble et al., 1989; Beeman and Maule, 2006). Beeman et al. (2003) determined a median rearing/migration depth for juvenile Chinook salmon in 1999 in the McNary Reservoir of 8 ft, with a range of water column depths from the water surface to about 33 ft. Steelhead had a slightly deeper median rearing/migration depth of 9 ft, as well as a greater range of depths, from the water surface to about 39 ft. Unfortunately, this study (as well as Dauble et al. [1989], which was conducted in the Hanford Reach) was not conducted in the LCRE. In both studies, the median migration depth was well above seachest depths, indicating that most fish would be located in shallower water. However, because fish behavior may be significantly different between the estuary and the freshwater mainstem sites, the applicability of these studies is suspect.

Carlson et al. (2001) sampled fish between Puget Island and Welch Island in the freshwater portion of the estuary. The study has been described by NMFS (2005) as finding "juvenile salmonids using water column depths ranging from 22 to 37 ft." However, the authors used a method (hydroacoustics) that could not sample the upper 2.75 m (9 ft) of the water column and could identify only undifferentiated "fish," not just juvenile salmonids. In actuality, what the authors found during sampling in 1998 was that, "most fish in the inshore habitat were detected within 2 m of the bottom…At the channel margin, the highest densities of the fish were detected between 3 and 10 m from the bottom…In the channel, the highest densities of the fish were detected between 5 and 15 m from the bottom." The navigation channel was characterized as the deepwater region, usually greater than 15 m, with a rather uniform bottom. The channel margin was a sloping region with a noticeable gradient leading from the channel up to the inshore area. The inshore region was characterized as a shallow area near the bank where the water was normally less than 7 m deep.

The seachests will be located approximately 5 m above the riverbed, in channel-type habitat. This depth is at the deeper extreme of where "most" fish were found in the Carlson et al. (2001) study. And again, it must be stressed that the upper water column could not be sampled by Carlson et al. (2001), and the observed fish were not necessarily salmonids. Sampling was done from July 14 to 16, after peak salmonid outmigration. This period coincides with the latter part of the shad migration, when many other fish species are also present.

Because there is no information to suggest that juvenile ESA-listed salmonids are concentrated in the 25- to 37-ft-depth range where the seachests are located, data from

Dawley et al. (1986) were assumed to be the most reliable. Therefore, the occurrence of juvenile salmonids within the water column was represented by a triangle distribution, with between 60 and 99 percent of the juvenile salmonids migrating through the LCRE in water less than 20 ft deep, with 95 percent occurrence above seachest depth being most probable.

Summary

With the exception of chum (which were assumed to be unsusceptible to entrainment based on their horizontal and vertical distribution), fish distribution is assumed to be the same regardless of species. The number of fish in the Area of Interest is calculated as follows:

> Fish in Area of Interest = (percent of fish on Oregon side * [1 percent of fish in top 20 ft of water])

This was modeled as a triangle distribution, as shown in Table 11.

TABLE 11
Fish Distribution Model Input Variables

	Lowest Possible	Most Likely	Highest Possible
Percent of total fish on the Oregon side	20%	40%	50%
Percent of fish in top 20 feet of water	60%	95%	99%

The area of the capture zones, and thus the percentage of the Area of Interest they occupy, varies based on the water withdrawal scenarios, as illustrated in Table 5. For each scenario, the number of annual fish passing through the potential capture zones is calculated as follows:

> Annual number of fish passing through a capture zone =
> Annual fish in Area of Interest* area of potential capture zone/Area of Interest

The result is then summed for all four zones (Zones 1 through 4).

Behavioral Response

Many aspects of salmonid behavior could potentially affect their susceptibility to entrainment, such as the following:

- How salmonids react upon encountering an in-water obstacle such as an LNGC and the LNGC dock, which will be outfitted with lights (attraction/avoidance behavior)
- How salmonids perceive and avoid intake velocities such as those at the seachests (response to intake velocities)
- Diel migratory behavior
- Tidal cycle migratory behavior

An overarching assumption in the model, which has been questioned by ODFW reviewers, is that each juvenile salmonid moves past the Terminal only once on its downstream migration. There is significant support (discussed below) that at least for stream-type fish, this is likely the case. However, because some subyearling salmonids may be rearing in the vicinity of the Terminal, they could theoretically pass through a capture zone multiple times. Multiple passes through a capture zone have the effect of increasing the population of "entrainable" fish. In other words, the final results assume one pass through the LCRE per fish; if additional passes through the LCRE are assumed, the final results can simply be multiplied by the number of assumed passes.

Attraction and Avoidance

Very little is known about salmonid behavior in response to in-water obstacles and artificial light. Simenstad et al. (1999) reviewed the available literature and found that fish response to overwater and in-water structures was highly variable and appeared to reflect variable conditions (e.g., adjacent shorelines, dock dimensions and material, artificial lighting) that affected observations. Toft et al. (2004) studied juvenile salmonid responses to shoreline habitats by using snorkel surveys and enclosure nets. The authors found that most juvenile salmonids were either schooling or swimming away from overwater structures and deep water with riprap substrate (overwater structures were large apartment or business complexes constructed on a pier, where average water depth was 3.0 m [9.78 ft; while deep riprap had a mean depth of 2.4 m [7.9 ft]). The authors concluded, in part, that, "it seems that when juvenile salmonids are migrating along the shoreline and encounter a modified habitat with the shallow water zone truncated, they may be forced to inhabit deeper water and also school more, as juvenile salmonids had significantly greater school sizes at overwater structures than at the other habitat types" (Toft et al., 2004). Shallow-water habitat will not be abruptly truncated at the Terminal but, instead, will grade gradually down to the maximum berth/turning basin depth.

The Terminal location is 2,100 ft offshore, and there is significant shallow-water habitat available between the berth and shore through which juveniles could migrate. Unfortunately, the effect that the presence of Youngs Bay has on shore-oriented, migrating, juvenile salmonids is unknown. Because of a lack of reliable and consistent data on fish response to artificial light or in-water structures, it was impossible to incorporate a metric into the model that would account for attraction or avoidance at the Terminal. The only way that fish entrainment would be increased over that assumed by the model would be if, upon encountering the LNGC and Terminal on their downstream migration, juvenile salmonids were concentrated within the Area of Interest and remained there until they tired and were entrained. It is difficult to imagine a plausible reason for such behavior.

Diel Migratory Behavior

Dawley et al. (1986) found little downstream movement by juvenile salmonids at night, and McComas et al. (2007 and 2008) did not find large differences between day and night migration, although fish may have been migrating more actively during the day. While Dauble et al. (1989) found more active migration at night, Carter et al. (2009) reported that acoustic-tagged salmonid smolts were present in the Columbia River estuary throughout all times of day during their migration seasons, with no clear patterns in diel presence at most acoustic arrays. The one exception was that more yearling Chinook salmon appeared to pass the Columbia River Bar (RM 1.75) just after sunrise than at other times of the day. Because of a lack of consistent findings with regard to salmonid diel movements and the fact that the ballast and cooling water withdrawals will vary over the course of a 24-hour period in an unpredictable manner, it was impossible to incorporate a metric into the model to account for diel movement patterns. Thus, for each hour in any given day, the number of fish moving past the Terminal was assumed to be constant.

As stated above, it was also assumed that fish move past the Terminal once on their downstream migrations, rather than holding near the Terminal or moving back and forth through the capture zones more than once. This is supported by recent studies indicating that median travel times from Bonneville Dam through the mouth of the Columbia River estuary are from approximately 3 to 4 days for both yearling (116 to 226 mm in length) and upriver-origin subyearling (94 to 155 mm) Chinook salmon (McComas et al., 2007 and 2008).

Data in Carter et al. (2009) allow for finer grained estimates of downstream salmonid speed. The authors found that larger smolts tend to move more rapidly than their smaller cohorts. Acoustic telemetry data collected in the Columbia River estuary between 2004 and 2008 indicated that yearling Chinook salmon typically migrated at a rate of about 80 kilometers (km) per day between Bonneville Dam and Vancouver, Washington. Yearling Chinook salmon migrated slower (approximately 60 km per day) through the section of the Columbia River between Vancouver and the mouth of the Columbia River, but once they committed to leaving the Columbia River, typically during an ebb tide, they migrated rather quickly at rates between 100 and 150 km per day between RM 5.2 and RM 1.75. Taken as a whole, data collected on arrays of acoustic receivers placed throughout the Columbia River estuary beginning in 2007 indicate that yearling and subyearling Chinook salmon and steelhead travel more slowly in the final 50 km of the Columbia River than in the previous 200 km, before substantially increasing their travel rates as they exit the river and enter the Pacific Ocean. Increased travel rates were noted at RM 5.2, but it is unknown whether the fish have started to increase their migration speed at the Terminal location (RM 11) or whether their travel rate there is more similar to areas slightly upriver. However, even when the fish were described as migrating “more slowly” through the lower 50 km, their travel rates were still 32 to 40.8 km per day for subyearling Chinook, 76 km per day for steelhead, and 45.4 km per day for yearling Chinook.

Such rapid travel times indicate that juvenile salmonids are not holding in the LCRE near the Terminal, although they likely rear extensively in island complexes upriver of the Terminal and in shallow shoreline areas. This is further supported by the findings of Truelove (2005), who observed no extended periods of holding in juvenile salmonids within the Columbia River estuary during tracking studies.

Tidal Cycle Migratory Behavior

When smolts reach the lower 8 km of the Columbia River, they most often exit the river and enter the plume on an ebb tide (Carter et al., 2009). It is reasonable to assume that juvenile salmonids would migrate downstream faster on the outgoing tide than they do on the incoming tide. Unfortunately, aside from that reported in Carter et al. (2009), there is very little information on salmonid behavior or migration rates in response to tidal conditions. Truelove (2005) found that spring/summer and fall Chinook, along with steelhead, swam more passively when the current was moving out of the estuary and more actively during slack current. When the current was moving into the estuary, however, steelhead were the only fish to exhibit passive swimming behavior, while spring/summer and fall Chinook swam actively against the current. Unfortunately, relatively few steelhead and fall Chinook were recorded during slack and incoming currents, which limits the conclusions that can be drawn.

Because ships will be present during all tidal conditions (and it is impossible to predict the portion of time they will spend at port during incoming, slack, and outgoing tides), it was not practical to incorporate differential entrainment rates due to tidal cycle in the model.

Response to Intake Velocities

In order for juvenile salmonids—even those with strong swimming abilities—to avoid entrainment, they would need to sense and then swim away from the intakes. It has been reported that fish are capable of sensing even small velocity differences of 0.328 ft/sec (Jones, 1968; in Bell, 1991). When different velocities are sensed, fish may avoid moving from one gradient to another, preferring to stay within water of constant velocity (Bell, 1991). Therefore, it was assumed that salmonids would sense, and at least attempt to swim away from, the seachests. It was assumed unlikely that a fish migrating downstream past the Terminal would sense the intake, change course, and swim directly into the seachest. This is supported by the fact that salmonids tend to avoid enclosed areas and channels with overhead cover (Kemp et al., 2005; Bell, 1991).

Given the assumption that all juvenile salmonids that encounter the seachests will attempt to escape before being entrained, it is then necessary to establish the minimum size salmonid that would be capable of escaping. Salmonids are strong swimmers, able to navigate rapidly flowing rivers and ocean currents. However, swimming speed is a function of fish size, with maximum and optimal swimming speed increasing with fish length, up to a certain point (Groot et al., 1995). In other words, larger fish are able to swim faster.

Many authors have studied swimming ability, which is normally divided into three categories: cruising, sustained (or prolonged), and burst (or darting) speed. Cruising speed is the speed fish are capable of sustaining nearly indefinitely (longer than 200 minutes). Sustained swimming speed can be maintained for 15 seconds to 200 minutes, and burst speed can be maintained for less than 15 seconds and requires a recovery period (Groot et al., 1995). There is no guidance on salmonid ability to avoid unscreened intakes, but in regard to setting acceptable velocities at fish screens, Turnpenny et al. (1998) state the following:

> "Burst speeds are used only when the fish are strongly motivated, e.g. for darting at prey and to escape from danger…When not provided with a suitable escape route, fish will often be drawn into an intake, even though the intake approach velocity may be well below their burst speed potential; only when the water velocity is in the [sustained] to [cruising] swimming speed range of the fish do they move out of danger…Consequently, the [cruising] swimming speed is, in most cases the safest measure of setting the approach velocity…provided that the velocity is below the maximum [cruising] swimming speed, a fish should be able to swim ahead of the screen for several hours. Designs based on [sustained] swimming capability may be acceptable in situations where fish are demonstrably capable of finding the bypass route quickly. "

In the case of the seachest, the "bypass route" is effectively all directions away from the seachest, and therefore a defensible argument could be made for applying sustained swimming speed as the most applicable escape criterion. In the initial modeling effort, it was assumed that fish would attempt to escape using only their cruising speed. This was an overly conservative assumption.

Before being drawn into an intake, an individual fish would logically attempt to escape with increasing urgency. Unfortunately, there are no data on fish response to seachest intakes. Therefore, using best professional judgment, it was assumed that the proportion that would attempt to escape using cruising speed would follow a triangle distribution, as shown in Table 12.

TABLE 12
Percent of Time Escape Is at Cruising Speed

Lowest Possible	Most Likely Condition	Highest Possible
30%	35%	80%

It was assumed that the remaining fish (which did not attempt to escape using cruising speed) would attempt to escape using sustained speed (60/65 [92 percent] of the remainder) or burst speed (5/65 [8 percent] of the remainder). In other words, under the most likely scenario, for every 100 fish, 35 would attempt to escape using cruising speed, 60 would attempt to escape using sustained speed, and 5 would attempt to escape using burst speed. At the high end of the cruising speed estimate, for every 100 fish, 80 would attempt to escape using cruising speed, 18 would attempt to escape using sustained speed, and 2 would attempt to escape using burst speed. The cruising, sustained, and burst speeds obtainable by the individual fish varied with their size distributions, as described below.

Salmonid Swimming Abilities

Cruising swimming speeds are determined through bioassay principles. Times to fatigue are measured for fish swimming at various constant speeds. Sustained (or prolonged) speeds are also reported as "critical" swimming speeds, measured by using an increasing-velocity test (Groot et al., 1995). Groot et al. (1995) report cruising speed to be approximately 2.5 body lengths per second (bl/sec), sustained speed to be 3 to 5 bl/sec, and burst speed to be 4.5 to 12 bl/sec. Critical swimming speeds have been reported by numerous authors, but they are often reported in different units, from bl/sec, to ft/sec, to cm/sec. Table 13 presents the available data for salmonids in the units reported in the source documents, and converted to ft/sec.

TABLE 13
Salmonid Swimming Abilities

Species	Life Stage	Size (mm)	Critical Swimming Speed (reported units)	Speed (ft/sec)	Source
Atlantic salmon	Parr	57	9.8 bl/s	1.83	Peake et al., 1997
Unspecified salmon	Parr	100	7.3 bl/s	2.4	Peake and McKinley, 1998, in Turnpenny et al., 1998
Atlantic salmon	Parr	134	6.2 bl/s	2.72	Peake et al., 1997
Atlantic salmon	Smolt	152	7.5 bl/s	3.74	
Unspecified salmon	Smolt	120	7.1 bl/s	2.8	Booth et al.,1996, in Turnpenny et al., 1998
Sockeye	NR	77.7 (mean)	8.3 bl/s	2.12	Taylor and Foote, 1991
Kokanee	NR	77.5 (mean)	7.3 bl/s	1.86	
Sockeye	NR	91.4 (mean)	6.6 bl/s	1.98	
Kokanee/sockeye hybrids	NR	91.9 (mean)	6.6 bl/s	1.99	
Sockeye	NR	150 (approx.)	5 bl/s	2.4	Groot et al., 1995
Coho	NR	51	≤ 0.5 ft/sec	≤ 0.5 ft/sec	Bell, 1991
Coho	NR	89	≤ 1.0 ft/sec	≤ 1.0 ft/sec	
Coho	NR	121	≤ 1.3 ft/sec	≤ 1.3 ft/sec	
Sockeye	NR	127	1.75 ft/sec	1.75 ft/sec	

Abbreviations:

NR = not reported.
bl/s = body length per second.
ft/sec = feet per second.

Aside from Bell (1991), who offers no source information for his data, the results are remarkably consistent for fish of different sizes—generally in the 2 ft/sec range for critical (sustained) swimming speed. The maximum intake velocity at the face of the seachest will be approximately 2.2 ft/sec, indicating that few juvenile salmonids would be susceptible to entrainment.

In the initial modeling, a very conservative escape speed was assumed—2 bl/sec as suggested by Turnpenny et al. (1998), who stated, "The safe and easy option (although not necessarily the lowest cost option) is to adopt widely accepted standard criteria for fish escape velocity. " Their stated "widely accepted standard" criterion was 2 bl/sec.

It should also be noted that cruising speed is affected by salinity and temperature. In spite of the large inflows and tidal exchanges, which lead to a widely varying salinity and temperature regime (both daily and annually), the temperature and salinity at the Terminal location remain well within the tolerance limits of juvenile salmonids. Therefore, it was assumed that temperature and salinity variations would not cause significant changes in swimming performance.

As can be seen from Table 13, the lowest reported critical swimming speed is 5 bl/sec (except for the Bell [1991] data, which are suspect). Burst speeds have not been well defined (Groot et al., 1995), but they have been reported to exceed 10 bl/sec (Groot et al., 1995) and are assumed to be higher than the highest reported critical swimming speed of 9.8 bl/sec. For the purposes of modeling, escape speeds were assumed to be as shown in Table 14.

TABLE 14
Estimated Escape Speed

Movement	Speed (bl/s)
Burst	10
Sustained	5
Cruising	2

bl/s = body length per second.

Because swimming speed (in ft/sec) is dependent on body length, length data were obtained from various sources, including Mr. Dean Ballinger of the Pacific States Marine Fisheries Center fish counting facility at Bonneville Dam. Table 15 contains the mean lengths and size ranges for various species as reported in 2008.

TABLE 15
Mean and Range Fish Lengths for Various Species at Bonneville Dam in 2008

Species	Mean Length (mm)	Minimum (mm)	Maximum (mm)	Number of Fish Sampled
Yearling Chinook	144.8	85	266	4,630
Subyearling Chinook	107.5	60	206	8,825
Non-ad-clipped steelhead	199.7	115	353	843
Ad-clipped steelhead	234.7	118	373	1,436
Coho	139.5	75	214	2,165
Sockeye	130.1	77	197	865

mm = millimeters.
Source: Ballinger, 2009.

The fish lengths input to the model are based on these data. Because length frequency distribution was not available, lengths were assumed to follow a triangle distribution using the minima, maxima, and means. Because lower river subyearlings are smaller, the population of subyearling Chinook was again divided into lower river and upriver components. The lengths from Bonneville (Table 15) were used for upriver subyearling Chinook. For lower river subyearling Chinook, data from Bottom et al. (2008) were used. Lower river subyearling Chinook were assumed to range from 35 to 150 mm, with a mean of 85 mm.

In the initial modeling (reported in the May 22 memo), only two velocity “capture zones” (instead of four) were established at the seachests. The first (Zone A) was the area in the immediate vicinity of the seachest where velocities exceed 0.66 ft/sec or 2 bl/sec for a 100-mm fish. Zone B extended from the 0.66 ft/sec line to the maximum extent of influence around the seachests, where the intake velocity exceeded 0.4 ft/sec. It was assumed that only fish less than 100 mm in length would be entrained within Zone B, while all fish regardless of size (and, hence, regardless of swimming ability) would be entrained in Zone A. This was an overly conservative assumption.

Methods Summary

The probabilistic model takes into consideration multiple factors. First, it considers the size of the various capture zones around the seachests (where velocities exceed previously established criteria), based on ship water needs and likely tidal conditions. Then it determines what percentage of the time (annually) those capture zones are present and what percentage of the Area of Interest the capture zones occupy. Then, it calculates the number of fish of each species that are likely to pass through each capture zone annually based on total fish populations, and their distribution horizontally and vertically. Finally, it determines how many of each fish species are likely to escape from each capture zone based on swimming ability (which is size related) and their assumed reaction (cruising, sustained, or burst speed). The variables input to the model are summarized in Table 16.

TABLE 16
Model Inputs

Variable	Deterministic Values	Probabilistic Values: Lower Limit	Probabilistic Values: Most Likely	Probabilistic Values: Upper Limit
Cross-sectional area of LCRE between Oregon side and Desdemona Sands	263,875 ft^2			
Cross-sectional area between surface and –20 feet Mean Tide Level	149,750 ft^2			
Cross-sectional area between –20 feet mean tide level and river bottom from Oregon shore to Desdemona Sands (the Area of Interest)	114,125 ft^2			
Percentage of time slack tide (no cross flow)		10%	20%	30%
Percentage of time cross flow		1 percent of time slack tide		
Percentage of time ships would be 148,000-m^3 class		0%	45%	100%
Percentage of time ships would be 213,000-m^3 class			35/55 of those not 148,000 m^3	
Percentage of time ships would be 266,000-m^3 class			20/55 of those not 148,000 m^3	
Percentage of time ships would operate only one seachest	10%			

TABLE 16
Model Inputs

Variable	Deterministic Values	Probabilistic Values		
		Lower Limit	Most Likely	Upper Limit
Percentage of total juvenile population on the Oregon side (between Desdemona Sands and Oregon shore)		20%	40%	50%
Percentage of total juvenile population in water 20 feet deep and less		40%	95%	99%
Burst speed	10 bl/sec			
Sustained speed	5 bl/sec			
Cruising speed	2 bl/sec			
Percentage of fish that will attempt to escape using cruising speed		30%	35%	80%
Percentage of fish that will attempt to escape using sustained speed			60/65 of those not using cruising speed	
Percentage of fish that will attempt to escape using burst speed			5/65 of those not using cruising speed	
Lower river subyearling Chinook size (mm)		35	85	140
Upper river subyearling Chinook size (mm)		60	108	206
Yearling Chinook size (mm)		85	145	266
Coho size (mm)		75	140	214
Steelhead size (mm)		115	222	373
Sockeye size (mm)		77	130	197

Abbreviations:
ft^2 = square feet.
m^3 = cubic meters.
bl/sec = body lengths per second.
mm = millimeters.

This methodology differs significantly from the initial methodology in that it takes into consideration many additional variables and attempts to apply probabilities to each of the uncertain variables. Table 17 summarizes the differences between the two models and the rationale for changing the initial assumptions.

TABLE 17
Variables and Assumptions Used in the Initial Modeling Approach and the Revised Approach

Variable/Assumption	Previous Approach	Revised Approach	Rationale
Seachest depth	30 ft (9 m) deep	Unchanged.	Industry sources indicate that seachests are located at depths of 27 to 35 ft below water line.
Ballast and cooling water needs	Assumed maximum withdrawal rate (85 ft^3/sec) for 20 hours per ship	Adjusted the amount of water required based on the expected annual distribution of ship types.	Industry sources provided typical ballast and cooling water estimates for various classes of ship. The initial approach was overly conservative.
Ballast and cooling water withdrawal operations	Assumed only one seachest in operation at all times	Assumed one seachest in operation 10% of the time, two in operation 90% of the time.	Industry sources indicate that the use of two seachests is the typical practice. The initial approach was overly conservative, and Oregon LNG will contractually require shippers to operate two seachests unless there is an overriding reason not to do so.
Tidal flow	Assumed slack water at all times	Assumed slack water follows a triangle distribution as shown in Table 16. Average tidal flow is 1 percent slack water	Initial approach was overly conservative; revised approach is based on Coast and Harbor Engineering modeling and represents typical tidal flow.
Seasonal fish abundance (temporal distribution)	Used Bonneville Dam passage and lower Columbia River sampling data to construct passage curves, and distributed ships at 3- and 4-day intervals during the passage period.	Simply used the percentage of the year during which ships would be withdrawing water: 15.4% of the year for ballast and cooling water withdrawal, 8.6% of the year for cooling water withdrawal only.	Earlier modeling indicated that entrainment numbers were nearly identical using the two methods, and the “percentage time” method is much simpler to calculate.
Annual fish abundance	Used 3-year mean from Ferguson (2006, 2007, and 2008)	Unchanged.	Used best available data.
Horizontal distribution	Assumed equal distribution from Oregon to Washington sides	Split population around Desdemona Sands using a triangle distribution as shown in Table 16.	The little available evidence suggests that more fish use the north shipping channel (McComas et al., 2007 and 2008; Truelove, 2005).

TABLE 17
Variables and Assumptions Used in the Initial Modeling Approach and the Revised Approach

Variable/Assumption	Previous Approach	Revised Approach	Rationale
Vertical distribution	Assumed equal distribution throughout the water column, except for subyearling Chinook	Assumed that 60% to 99% of all juvenile salmonids occur in the upper 20 ft of the water column, modeled as a triangle distribution as shown in Table 16. The remainder of the fish were assumed to be evenly distributed through the lower water column.	The available evidence suggests that the majority of juvenile salmonids occur in the upper 10 ft of the water column, with the majority of the remainder in the upper 20 ft (Dawley et al., 1986; NMFS, 2006; Bottom et al., 2005; Truelove, 2005).
Fish swimming ability	Assumed that a cruising speed of 2 bl/sec was the maximum swimming ability	Established cruising speed as 2 bl/sec, sustained speed as 5 bl/sec, and burst speed as 10 bl/sec.	Actual fish swimming ability is much greater than 2 bl/sec, which was used in the initial model as a very conservative rule of thumb.
Fish size	Fish size was obtained from multiple sources for different species	Unchanged.	Best available data obtained from Bonneville Dam and published sources were used.
Fish response	Assumed that all fish would attempt to swim away from the seachests at cruising speeds	Assumed that all fish would attempt to swim away from the seachests, but at various speeds.	Data are limited, but if the fish sense a “pull” into the seachest, they are likely to attempt to escape. Escape path is effectively all directions away from the seachest.
Migration	Assumed all fish swim past the Terminal only once	Unchanged.	Migration rates indicate that fish do not spend significant time in the LCRE, except subyearling Chinook, which are likely to be located in shallow water near shore.
Entrainment “zones”	Divided area around seachests into two “zones,” the areas experiencing velocities > 0.6 ft/sec and 0.6 to 0.4 ft/sec	Divided “zone of influence” area around seachests into four “zones” (0.4 to 0.8, 0.8 to 1.2, 1.2 to 1.6, and 1.6 to 2.2 ft/sec), modeled using a uniform distribution within each range.	Allowed for a much “finer grained” and more realistic analysis of fish escape.

Abbreviations:

ft = feet.
m = meters.
bl/sec = body lengths per second.
ft^3/sec = cubic feet per second.
LCRE = Lower Columbia River Estuary.
ft/sec = feet per second.

Results

Before the total number of fish entrained annually can be determined, the number that are entrained per zone must be identified. The annual number of fish entrained per zone is equal to the number of fish in each potential capture zone that swim at a speed less than the intake velocity in that zone. The results are summed for each possible swim-speed response (cruising, sustained, burst) and then summed for all four zones.

The estimated annual entrainments by species are as shown in Tables 18, 19, and 20. Table 18 shows entrainment by species. Table 19 shows ESA-listed fish entrainment, which is entrainments by species times the percentage of each species that is ESA listed. Table 20 shows estimated entrainments by ESU. In the tables, the 50th percentile indicates that half of the model simulation iterations were above that number entrained, and half below. Likewise, the 90th percentile indicates that only 10 percent of the iterations had a higher level of entrainment. Another way of looking at this is an equal chance that the number of juvenile salmonids likely to be entrained is higher or lower than that presented as the 50th percentile number, while there is only a 10 percent chance that the number of juvenile salmonids entrained will be higher than that presented as the 90th percentile.

TABLE 18
Number of Fish Entrained Annually, by Species

	UR SY Chinook	LR SY Chinook	Yearling Chinook	Coho	Steelhead	Sockeye	Youngs Bay Coho
Minimum	0.0	0.0	0.0	0.0	0.0	0.00	0.0000
Maximum	21.0	58.9	24.2	12.9	2.8	2.28	0.0029
10.0%	0.1	1.0	0.1	0.1	0.0	0.00	0.0000
50.0%	1.0	4.2	0.3	0.3	0.0	0.04	0.0001
90.0%	4.1	15.7	2.1	1.6	0.2	0.16	0.0004

Abbreviations:

UR = Upriver.
SY = subyearling.
LR = Lower river.

TABLE 19
Number of ESA-Listed Fish Entrained

	ESA-listed SY Chinook	ESA-listed Yearling Chinook	ESA-listed Coho	ESA-listed Steelhead	ESA-listed Sockeye	ESA-listed YB Coho
Minimum	0.0	0.0	0.0	0.0	0.00	0.0000
Maximum	57.6	6.7	9.6	1.0	0.06	0.0021
10.0%	1.3	0.0	0.0	0.0	0.00	0.0000
50.0%	4.3	0.1	0.2	0.0	0.00	0.0001
90.0%	13.3	0.6	1.2	0.1	0.01	0.0003

Note:

The numbers of upriver and lower river subyearling Chinook from Table 18 are combined to include all subyearling Chinook.

Abbreviations:

ESA = Endangered Species Act.
SY = subyearling.
YB = Youngs Bay.

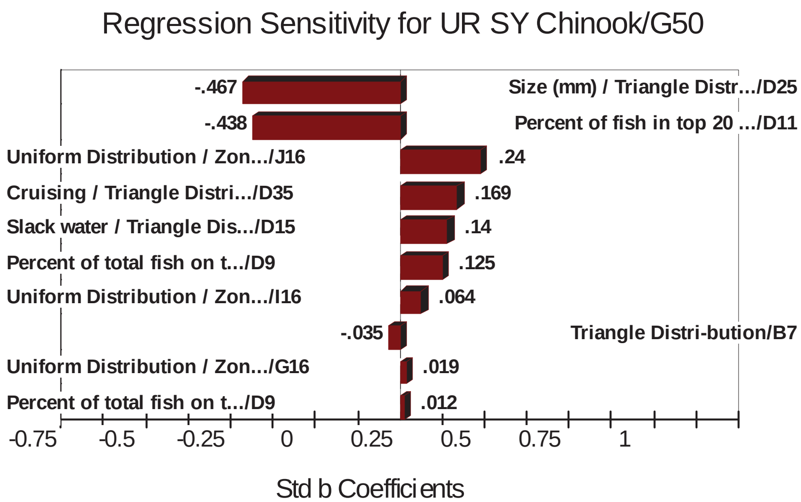
TABLE 20
Number of ESU Fish Estimated Entrained

ESU	Estimate Using Initial Methodology	Revised Methodology 50th Percentile	Revised Methodology 90th Percentile
Lower Columbia River fall Chinook	48	3.62	13.81
Snake River fall Chinook yearling and subyearling	2	0.15	0.56
Upper Columbia River spring/summer Chinook	5	0.00	0.03
Upper Willamette River Chinook	44	0.04	0.28
Snake River spring/summer Chinook	12	0.01	0.07
Lower Columbia River coho	128	0.22	1.19
Youngs Bay coho	0.1	0.00	0.00
Snake River sockeye	1	0.00	0.01
Lower Columbia River steelhead	13	0.00	0.02
Upper Columbia River steelhead	5	0.00	0.01
Middle Columbia River steelhead	16	0.00	0.03
Upper Willamette River steelhead	3	0.00	0.00
Snake River steelhead	28	0.00	0.04

ESU = Evolutionarily Significant Unit.

Figure 7 is an example tornado diagram. This diagram, for upriver subyearling (UR SY) Chinook, shows the relative importance of individual probabilistic variables to the total range of uncertainty in estimated entrainments. As shown, the most important uncertainties are fish size and the percentage of fish in the top 20 ft.

FIGURE 7
Example Tornado Diagram



Juvenile Salmonid Entrainment

The ESU with the largest number of individual fish potentially entrained, of any ESU, is LCR Chinook, with approximately four individuals (and up to a maximum of 56 individual smolts) entrained per year. The largest impact to any particular ESU (on a percentage basis) would be to Snake River fall Chinook, with a potential entrainment of 0.56 individuals annually for 0.00004 percent of the population. Table 21 contains the 3-year mean of the population of each ESU as calculated from Ferguson (2006, 2007, and 2009), the potential entrainment (based on the 90th percentile), and the percentage of the population that the potential entrainment represents.

When converted to adult equivalents using smolt-to-adult return (SAR) ratios from various hatcheries included in the ESUs (DART, 2009), entrainment due to ballast water withdrawal is responsible for the loss of much less than one adult from all ESUs (Table 22). Therefore, there would be essentially no effect on harvest or population recovery.

TABLE 21
Percentage of Each ESU/DPS Potentially Entrained

ESU/DPS	3-Year Mean Population of Juveniles at Tongue Point	Number Potentially Entrained	% of the Total Population
Snake River sockeye	74,151	0.007	0.00001%
Lower Columbia River coho	13,254,911	1.186	0.00001%
Chum	1,467,982	0.000	0.00000%
Snake River steelhead	3,144,333	0.043	0.00000%

TABLE 21
Percentage of Each ESU/DPS Potentially Entrained

ESU/DPS	3-Year Mean Population of Juveniles at Tongue Point	Number Potentially Entrained	% of the Total Population
Upper Columbia River steelhead	489,128	0.007	0.00000%
Middle Columbia River steelhead	1,061,491	0.025	0.00000%
Lower Columbia River steelhead	1,302,406	0.021	0.00000%
Upper Willamette River steelhead	279,199	0.004	0.00000%
Snake River spring/summer Chinook	1,265,731	0.075	0.00001%
Snake River fall Chinook	1,354,555	0.561	0.00004%
Upper Columbia River Chinook	460,405	0.033	0.00001%
Lower Columbia River Chinook	63,808,214	13.806	0.00002%
Upper Willamette River Chinook	4,662,659	0.282	0.00001%

ESU/DPS = Evolutionarily Significant Unit/Distinct Population Segment.

TABLE 22
Adults from Each ESU Potentially Lost Due to Entrainment of Juveniles

ESU	Total Estimated Entrainment	Mean SAR (years of data)	Hatchery	Adults Lost Due to Juvenile Entrainment
Lower Columbia River fall Chinook (tule)	12.5975791	0.008 (30)	Big Creek	0.1044
Lower Columbia River fall Chinook (late fall)	1.20815561	0.003 (3)	Big Creek	
Snake River fall Chinook yearling and subyearling	0.561235	0.009 (9)	Lyons Ferry	0.0051
Upper Columbia River spring/summer Chinook	0.03287735	0.004 (12)	Chiwawa	0.0001
Upper Willamette River Chinook	0.28178787	0.006 (25)	McKenzie	0.0017
Snake River spring/summer Chinook	0.07533177	0.002 (12)	Tucanon	0.0002
Lower Columbia River coho	1.18624	0.026 (25)	Bonneville	0.0308
Snake River sockeye	0.007424	0.002	Six hatcheries[a]	0.0000
Lower Columbia River steelhead	0.02093233	0.003 (12)	Skamania[b]	0.0001
Upper Columbia River steelhead	0.00725588	0.005 (6)	Wells	0.0000

TABLE 22
Adults from Each ESU Potentially Lost Due to Entrainment of Juveniles

ESU	Total Estimated Entrainment	Mean SAR (years of data)	Hatchery	Adults Lost Due to Juvenile Entrainment
Middle Columbia River steelhead	0.0254298	0.003 (16)	Umatilla	0.0001
Upper Willamette River steelhead	0.00395437	0.003 (7)	Clackamas[c]	0.0000
Snake River steelhead	0.04333903	0.004 (30)	Dworshak	0.0002

[a]Limited data are available on sockeye returns; therefore, data from all available hatcheries were pooled.
[b]No data for any of the artificial propagation programs included in the ESU were available. Skamania hatchery had the largest data set for steelhead in the Lower Columbia River hydrologic unit.
[c]No hatchery stocks are included in these ESUs.

Abbreviations:

ESU = Evolutionarily Significant Unit.
SAR = smolt-to-adult return.

The total number of fish entrained and their contribution to their respective ESUs are remarkably small. This is due, in large part, to the size of the LCRE at the Terminal location. Because the amount of available habitat is so large, the density of juvenile salmonids in any given hour when the ships are at port, in any particular square meter of water, is very low. If the Terminal were located in an upriver location, where habitat is much more restricted, juvenile salmonids would have much greater density (assuming equal horizontal and vertical distribution) and entrainment, consequently, would be higher.

As can be seen from Figure 7, the uncertain variable with the greatest impact on entrainment numbers is the percentage of fish in the top 20 ft of the water column. The majority of juvenile salmonids are believed to occur above this depth and therefore are not susceptible to entrainment. Additional data on juvenile salmonid vertical distribution in the water column would result in greater accuracy in the entrainment estimates.

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Appendix E
Conceptual Wetland Restoration Monitoring Plan and Performance Standards and Review of Wetland Avoidance and Mitigation Efforts

Conceptual Wetland Restoration Monitoring Plan and Performance Standards

Conceptual Wetland Restoration Monitoring Plan and Performance Standards—Oregon Pipeline Project

PREPARED FOR: Peter Hansen/Oregon Pipeline Company, LLC

COPY TO Jay Lorenz/CH2M HILL

PREPARED BY: Forrest Parsons/CH2M HILL
Claudia Steinkoenig/CH2M HILL

DATE: November 15, 2013

PROJECT NUMBER: 199863.PP.12

1.0 Introduction

On behalf of Oregon Pipeline Company, LLC, CH2M HILL has prepared a restoration monitoring plan for unavoidable temporary impacts to wetlands as a result of construction of the proposed Bidirectional Project (Project). The Project will temporarily impact wetland functions and values through disturbance of soil and removal of vegetation during the construction and installation of a buried liquefied natural gas (LNG) pipeline (Pipeline). The goal of this monitoring plan is to confirm that performance standards are properly followed and fulfill the objective of habitat restoration and avoidance or minimization of adverse effects to the ecosystem. In conjunction with this goal, a series of conceptual wetland restoration planting plans is provided in the attachment to this technical memorandum. The plans are arranged according to watershed, as shown in Figure 1 in the attachment.

Approximately 118 acres of temporary[1] wetland impacts will occur along the proposed Pipeline alignment. Oregon LNG will conduct onsite restoration and ensure the reestablishment of wetlands in the Pipeline corridor. This effort includes restoring soils and hydrology functions and revegetating disturbed areas with salvaged plant material, reseeding with native seeds, or replanting with native plants. Site restoration will include a functional lift of existing degraded plant communities through removal of non-native species.

2.0 Monitoring Plan

Seasonal monitoring will be conducted by a qualified botanist for a period of 10 years following final installation using the standards summarized below in Section 3.0, Performance Standards.

The monitoring report will consist of the following:

- Vegetation transect (or transects depending on size of wetlands that detail herb, shrub, and tree aerial cover at radii of 3 feet, 15 feet, and 30 feet, respectively)
- Percent of planted materials surviving, classified by condition (for example, vigorous, living, stressed)
- Percent cover for the following four classes: native forbs and grasses; non-native forbs and grasses; shrubs and trees; bare ground and rock
- Report on invasive vegetation, vandalism, dumping, wildlife damage or other conditions actually or potentially harmful to the restoration
- Identification of maintenance concerns (for example, plants need to be replaced)

[1] As defined in Oregon Administrative Rule 141-085-0010, temporary impacts means those impacts that do not result in the permanent loss of function and/or area and are rectified within 12 months of project completion.

- Color photographs that show the restoration site, taken from a fixed photo point (or points depending on size of wetland) drawn on a map of the restoration area, keyed to lines of sight from those photo points

Table 1 summarizes the proposed restoration monitoring plan schedule.

TABLE 1
10-Year Restoration Monitoring Schedule

	Monitoring and Restoration Activities			
	Season			
Year	**Winter**	**Spring**	**Summer**	**Fall**
1		Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Replant (As Needed)
2	Submit Results of Year 1 Monitoring	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Noxious Weed Control (As Needed)	Monitor Restoration Sites Replant (As Needed)
3	Submit Results of Year 2 Monitoring	Monitor Sites Deficient During Year 1 and 2 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 Replant (As Needed)
4	Submit Results of Year 3 Monitoring	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Noxious Weed Control (As Needed)*	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Replant (As Needed)
5	Submit Results of Year 4 Monitoring	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Not Monitored Year 4 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 and Monitor 50% of Sites* Not Monitored Year 4 Noxious Weed Control (As Needed)	Monitor Sites Deficient During Year 1 and 2 Monitor 50% of Sites Not Monitored Year 4 Replant (As Needed)
6	Submit Results of Year 5 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
7	Submit Results of Year 6 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
8	Submit Results of Year 7 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
9	Submit Results of Year 8 Monitoring	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Noxious Weed Control (As Needed)	Monitor Sites Deficient in Previous Year Replant (As Needed)
10	Submit Results of Year 9 Monitoring	Monitor All Restoration Sites Noxious Weed Control (As Needed)	Monitor All Restoration Sites Noxious Weed Control (As Needed)	Monitor All Restoration Sites Noxious Weed Control (As Needed)
11				Submit Final Reports

*Choose sites using a *stratified random* approach across watersheds.

3.0 Performance Standards

The proposed performance standards will be evaluated by a qualified biologist using best professional judgment. Table 2 summarizes the performance standards that will be used to evaluate success of the planting according to established landscape standards for wetland vegetation communities in the appropriate zones west of the Cascade Crest (Franklin and Dyrness, 1973).

TABLE 2
Summary of Performance Standards

Objective	Performance Standard
Ensure that all areas of wetland have hydrology through April 15	Hydrology present in accordance with USACE *Wetland Delineation Manual* (1987) 2 years with normal or below normal precipitation
Maintain structural diversity	Grass, shrub, and forest habitat diversity present to an extent equal or better than preconstruction conditions
Maintain species diversity	Plant a diverse assemblage of species native to the project area or region to an extent equal or better than preconstruction conditions
Ensure survivorship of trees and shrubs	Planting density within 5 percent of planting plan—typically 60 to 80 percent survivorship (native species recruitment on the site may be included) Increase aerial cover in successive years; 15 percent aerial cover of trees 3 years after planting; 40 to 60 percent aerial cover of shrubs after 3 years
Ensure survivorship of ground cover	30 to 50 percent ground after 1 year 60 to 80 percent ground cover 2 years after installation in emergent zones 50 percent ground cover within 2 years in shrub and forest habitat Bare substrate represents no more than 20 percent cover after 3 years
Make cover of noxious weeds and non-native species minimal	No more than 10 percent cover of invasive species such as reed canarygrass, Himalayan blackberry, Evergreen blackberry, purple loosestrife, kudzu, Japanese knotweed, thistles, and poison hemlock 3 years after installation

4.0 Maintenance

If any monitoring report shows that performance standards are not achieved, Oregon LNG will recommend corrective management actions. Wetlands with substandard performance will be monitored annually until there are two successive years demonstrating successful performance. Corrective actions may include invasive species control (typically spring/early summer); protective sleeves to minimize browsing damage by herbivores (typically applied spring/summer); and replanting (typically dormant or rainy season). Biologists will keep a written record to document the date of each visit, site conditions, and any corrective actions taken.

5.0 References

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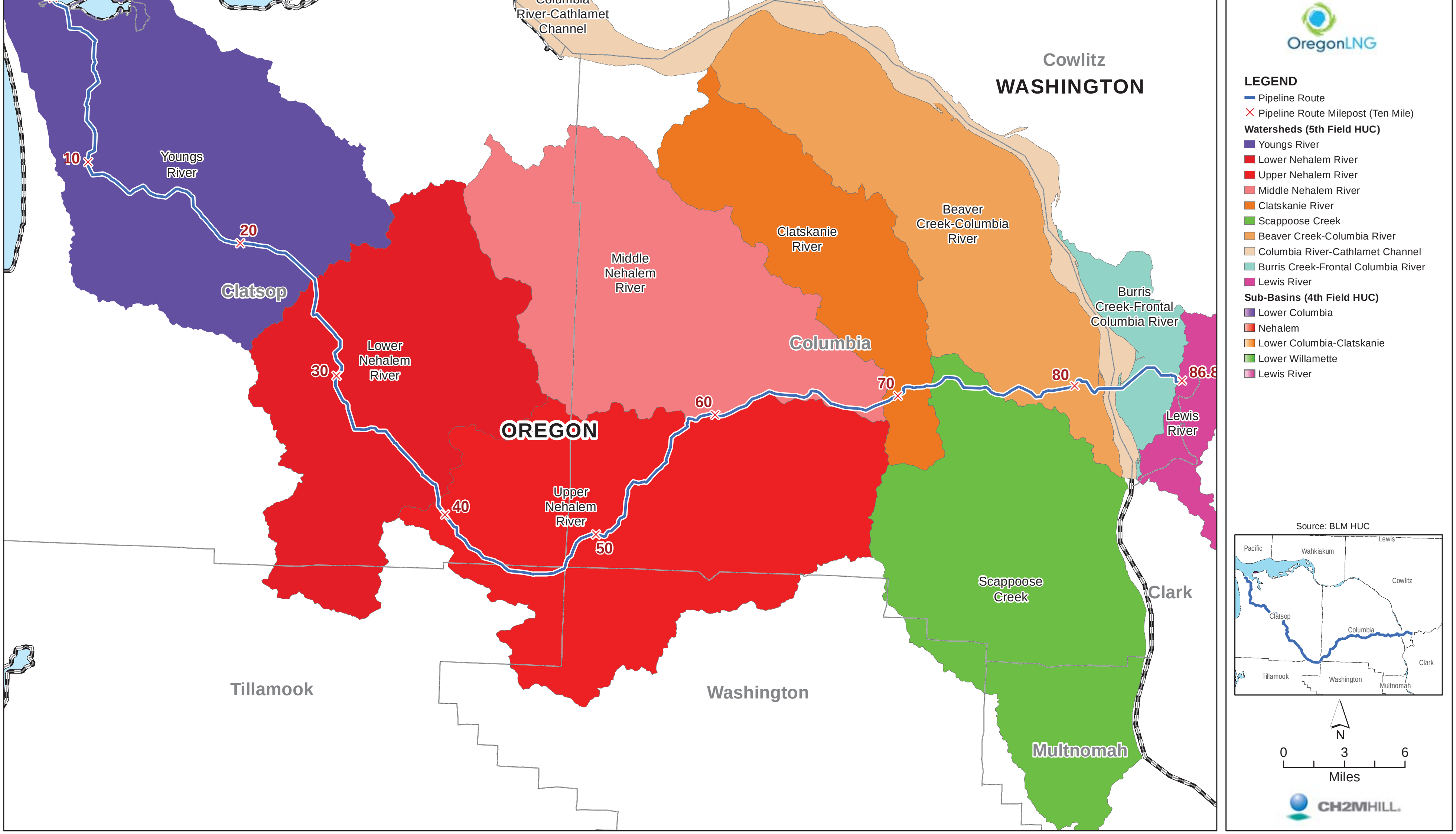
Attachment
Site Restoration Plans

Figure1 Watersheds Crossed by the Project



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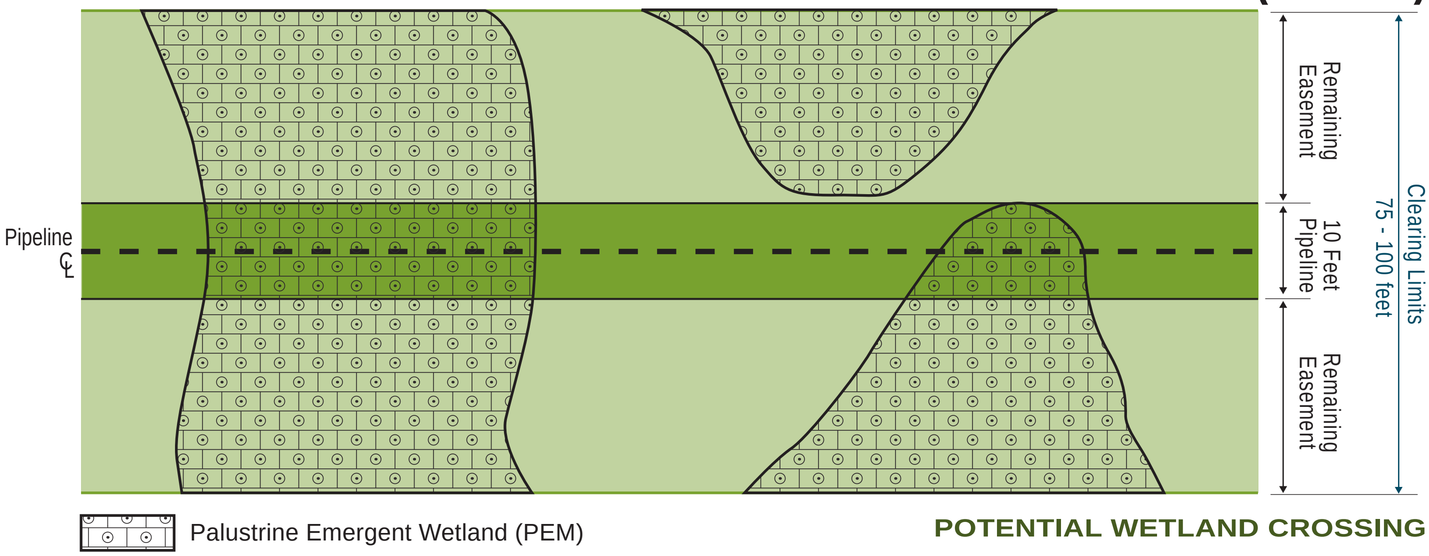
Lower Columbia Watershed (4th HUC)



SEED MIX #1 SEED MIX FOR COASTAL LOWLANDS — NON-AGRICULTURAL

Common Name	Scientific Name	Form*	Pounds per Acre Per Live Seed (PLS)
Pacific Reedgrass	*Calamagrostis nutkaensis*	Seed	8
Seaside Arrow Grass	*Triglochin maritima*	Seed	8
Fowl Bluegrass	*Poa palustris*	Seed	8
Tufted Hairgrass	*Deschampsia caespitosa var. artica*	Seed	2
Red Fescue	*Festuca rubra*	Seed	8
Lyngby's Sedge	*Carex Lyngbyei*	Seed	10
Baltic Rush	*Juncus articus var. baticus*	Seed	10

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

SEED MIX #2 SEED MIX FOR COASTAL FOOTHILLS — NON-AGRICULTURAL

Common Name	Scientific Name	Form*	Pounds per Acre Per Live Seed (PLS)
Red Fescue	*Festuca rubra*	Seed	8
Colonial Bentgrass	*Agrostis capillaris*	Seed	8
Slender Hairgrass	*Deschampsia elongata*	Seed	2
Slough Sedge	*Carex obnupta*	Seed	10
Small-fruited Bulrush	*Scirpus microcarpus*	Seed	10
Sickle-leaved Rush	*Juncus ensfolius*	Seed	10

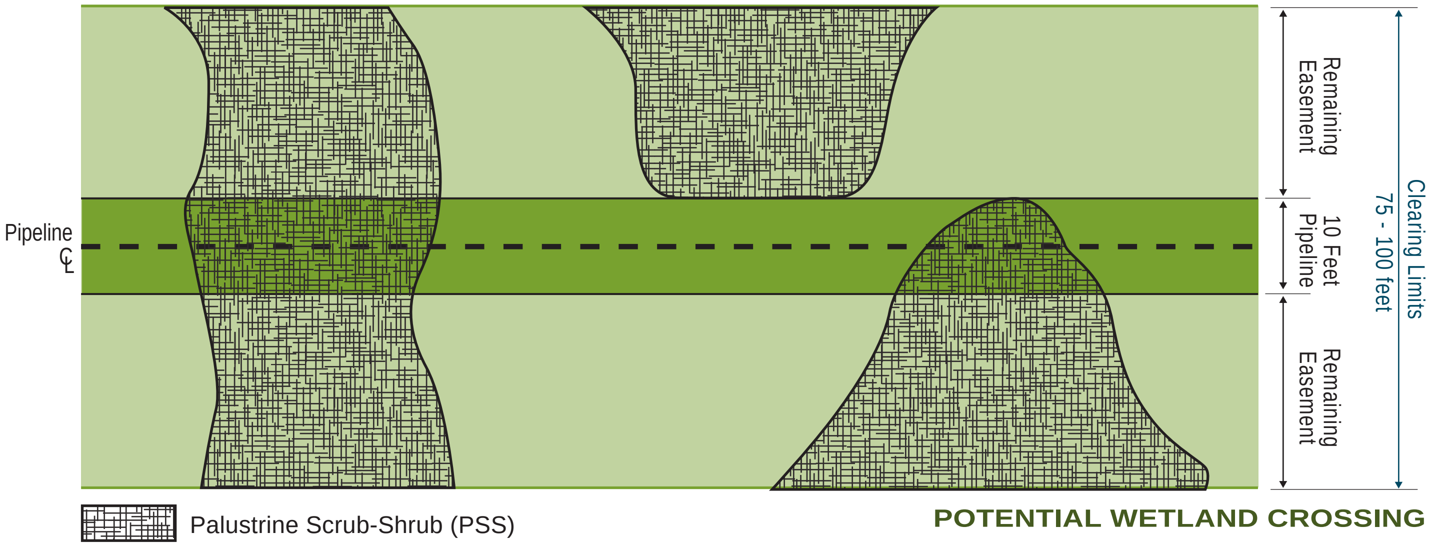
** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 2
Lower Columbia Watershed
Palustrine Emergent Wetland Restoration - Typical
OREGON PIPELINE PROJECT

OregonLNG

CH2MHILL

Lower Columbia Watershed (4th HUC)



SCRUB-SHRUB WETLAND COMMUNITY - SHRUBS, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Hooker Willow	*Salix hookeriana*	Live stake	8' o.c. (4 stakes/hole)
Douglas Spiraea	*Spiraea douglasi*	1 gal	6' o.c. Cluster of 9
Wetland Seed Mix #1 for Coastal Lowland/ Wetland Seed Mix #2 for Coastal Foothills			

* *Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 3
Lower Columbia Watershed
Palustrine Scrub-Shrub Wetland Restoration - Typical
OREGON PIPELINE PROJECT

OregonLNG

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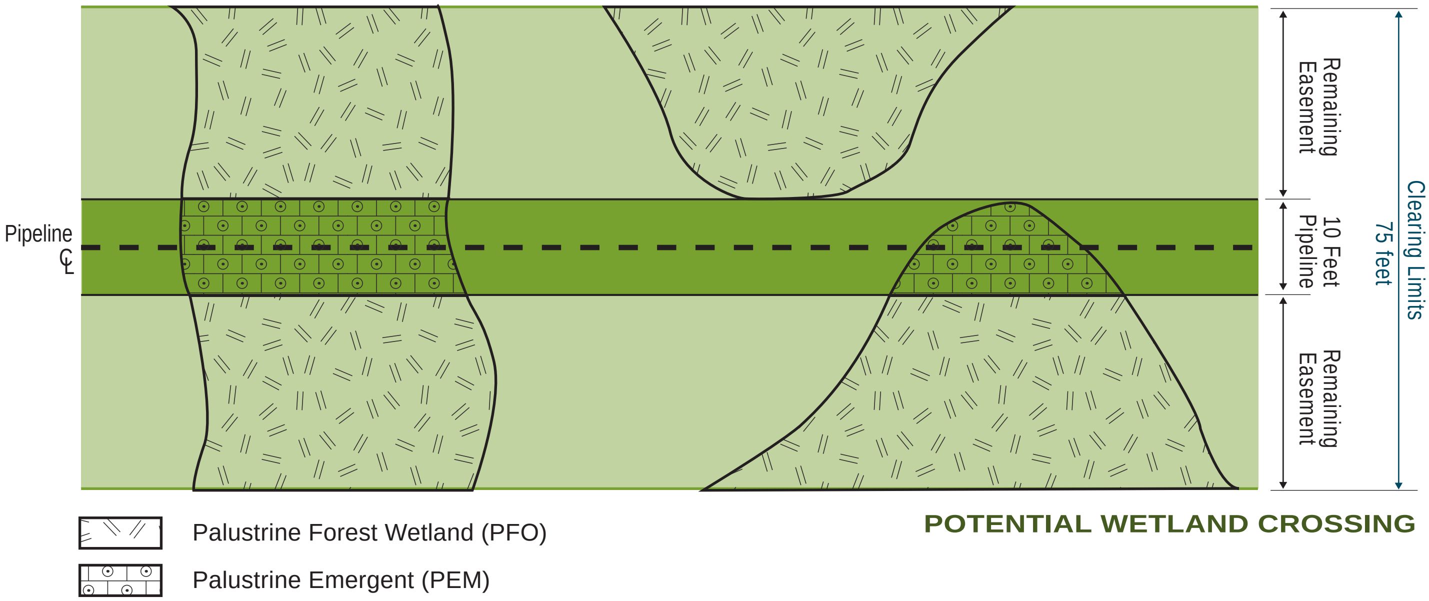
Lower Columbia Watershed (4th HUC)



SEED MIX #1 FOREST WETLAND COMMUNITY - FOREST, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Red Alder	*Alnus Rubra*	2 gal	10' o.c.
Western Red Cedar	*Thuja plicata*	2 gal	15' o.c.
Sitka Spruce	*Picea sitchens*	2 gal	20' o.c.
Wetland Seed Mix #1 for Coastal Lowland/ Wetland Seed Mix #2 for Coastal Foothills			

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 4
Lower Columbia Watershed
Palustrine Forest/Palustrine Emergent
Wetland Restoration - Typical
OREGON PIPELINE PROJECT

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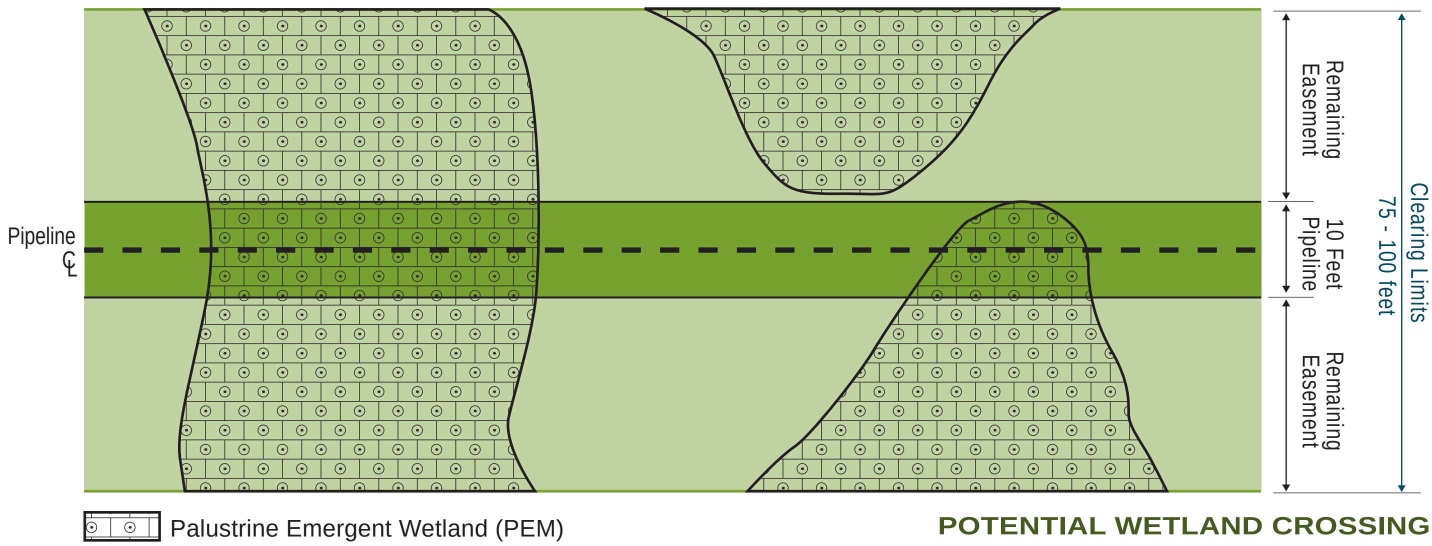
Nehalem Watershed (4th HUC)
Lower Columbia/Clatskanie (4th HUC)
Lower Willamette Watershed (4th HUC)



WETLAND SEED MIX #3

Common Name	Scientific Name	Form*	Pounds per Acre Per Live Seed (PLS)
Red Fescue	*Festuca rubra*	Seed	8
Colonial Bentgrass	*Agrostis capillaris*	Seed	8
Slender Hairgrass	*Deschampsia elongata*	Seed	2
Slough Sedge	*Carex obnupta*	Seed	10
Small-fruited Bulrush	*Scirpus microcarpus*	Seed	10
Sickle-leaved Rush	*Juncus ensfolius*	Seed	10

* *Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 5
Nehalem Watershed
Lower Columbia/Clatskanie
Lower Willamette Watershed
Palustrine Emergent Wetland Restoration - Typical
OREGON PIPELINE PROJECT

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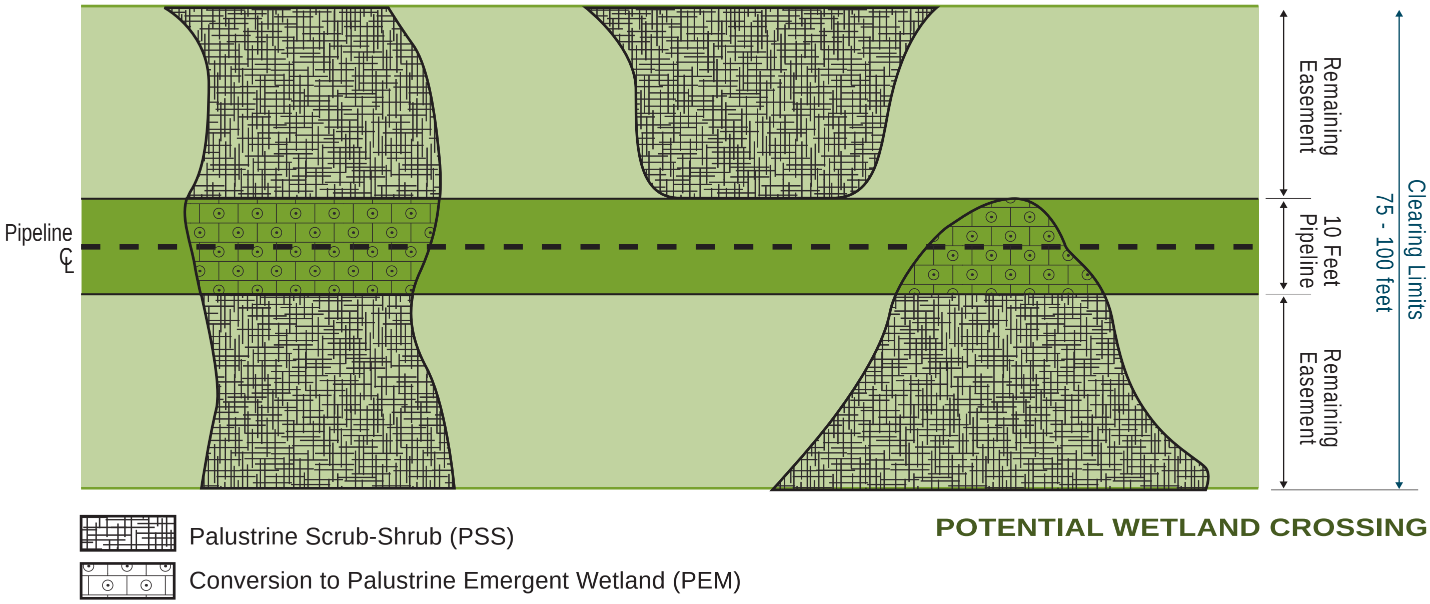
Nehalem Watershed (4th HUC)
Lower Columbia/Clatskanie (4th HUC)
Lower Willamette Watershed (4th HUC)



POTENTIAL WETLAND CROSSING

SCRUB-SHRUB WETLAND COMMUNITY - SHRUBS, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Red-osier Dogwood	*Cornus stolonifera*	1 gal	8-ft o.c. Cluster of 10
Salmonberry	*Rubus spectabilis*	1 gal	6-ft o.c. Cluster of 12
Wetland Seed Mix #3			

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 6
Nehalem Watershed
Lower Columbia/Clatskanie
Lower Willamette Watershed
Palustrine Scrub-Shrub Wetland Restoration - Typical
OREGON PIPELINE PROJECT

OregonLNG

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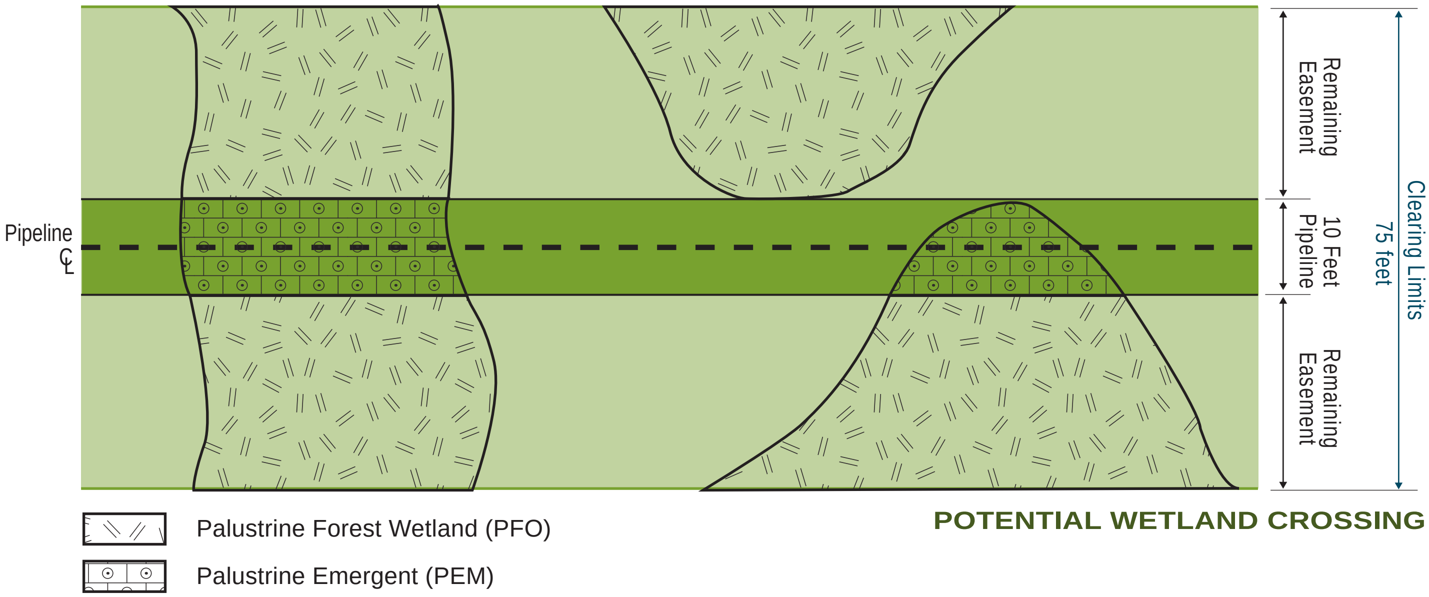
Nehalem Watershed (4th HUC)
Lower Columbia/Clatskanie (4th HUC)
Lower Willamette Watershed (4th HUC)



POTENTIAL WETLAND CROSSING

FOREST WETLAND COMMUNITY - FOREST, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Red Alder	*Alnus rubra*	2 gal	10’ o.c.
Western Red Cedar	*Thuja plicata*	2 gal	15’ o.c.
Sitka Spruce	*Picea sitchens*	2 gal	10’ o.c.
Wetland Seed Mix #3			

* *Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 7
Nehalem Watershed
Lower Columbia/Clatskanie
Lower Willamette Watershed
Palustrine Forest/Palustrine Emergent
Wetland Restoration - Typical
OREGON PIPELINE PROJECT

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Review of Wetland Avoidance and Minimization Efforts

Report

Review of Wetland Avoidance and Minimization Efforts Oregon LNG Terminal and Oregon Pipeline Project

Prepared for

Oregon LNG
Wetland Mitigation Subgroup

Originally Filed September 15, 2009

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Prepared by

CH2MHILL®

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SECTION 1.0

Introduction

On behalf of LNG Development Company, LLC (doing business as Oregon LNG) and the Oregon Pipeline Company, LLC (collectively, Oregon LNG), CH2M HILL has prepared this report to review efforts to avoid and minimize wetland impacts from the Oregon LNG Terminal and Oregon Pipeline Project (Project). Avoidance and minimization efforts are evaluated in the context of both the quantity of area and the wetland function.

1.1 Summary of Impacts

The Project will temporarily and permanently impact wetland functions and values as a result of disturbance of soil and removal of vegetation during the construction of a liquefied natural gas (LNG) receiving terminal (Terminal) and installation of a buried natural gas pipeline (Pipeline). Oregon LNG intends to avoid and minimize disturbance to wetlands associated with the construction and operation of the Project to the greatest extent possible while maintaining a viable project. Avoidance and minimization efforts are detailed in subsequent sections of this report and include alternate siting options for the Terminal and associated facilities, ongoing review of the Pipeline alignment, use of existing utility corridors and roads, relocation of temporary and additional temporary workspace (TWS and ATWS), construction methods, and reduced easement areas.

Preliminary wetland jurisdictional determinations were made for the wetlands and other waters identified in the Project study area. For the purposes of this analysis, the Pipeline study area is approximately 2,180 acres, encompassing a 200-foot-wide corridor centered on the proposed Pipeline. The study area at the Terminal is approximately 325 acres, encompassing the turning basin, dock and pier, facilities, and supporting infrastructure (entry road and electrical transmission line). Within this 2,505acre study area, which includes both the Terminal and Pipeline, approximately 391 acres of state and federal potential jurisdictional wetlands, including agricultural wetlands, were identified in field and desktop surveys. Jurisdictional delineations were conducted on properties with access. Desktop data (soil survey and National Wetland Inventory) were used to map wetlands on properties where access was denied.

Several potential Pipeline routes and Terminal layouts were analyzed before a 100-foot-wide Pipeline corridor and Terminal layout (construction area) was chosen that avoids impacts to environmentally significant areas to the greatest extent possible. The proposed Project area will impact (temporarily and permanently) an estimated 174 acres of the total wetlands in the current study area. About 18.10 acres of wetlands along the Pipeline are expected to be permanently impacted. Permanent impacts are calculated as those representing a change in Cowardin class from Palustrine Forested (PFO) to Palustrine Scrub-Shrub (PSS) or Palustrine Emergent (PEM), rather than a net loss of wetland area. Along the Pipeline and following construction, no wetlands will be filled above the existing grade or covered with impervious material. About 35.02 acres of wetlands at the Terminal (facilities, dock and pier, and supporting infrastructure) will be permanently filled above existing grade or covered with impervious material.

The remaining 120.7 acres of wetland impacts will be temporary as defined in Oregon Administrative Rules (OAR) 141-085 0510. To offset temporary impacts along the proposed Pipeline alignment, Oregon LNG will conduct onsite restoration and ensure the reestablishment of wetland and other aquatic resource characteristics and functions in the areas disturbed by the Terminal and Pipeline activities. This includes restoring soils and hydrology functions, and revegetating disturbed areas with salvaged plant material, reseeding with native seeds, or replanting with native plants. Further detail will be provided in a comprehensive restoration and rehabilitation plan. Table 1 summarizes the wetland acreages and impacts within the Project study area.

1.1 Project Background

LNG Development Company, LLC (doing business as Oregon LNG) proposes to own, construct, and operate a liquefied natural gas (LNG) bidirectional terminal (Terminal) consisting of marine facilities, LNG storage tanks, LNG vaporization facilities, natural gas liquefaction facilities, and associated support facilities. The Terminal will be located in Warrenton, Oregon. The Terminal will have a base load liquefaction capacity of 9.6 million metric ton per year, which requires approximately 1.25 billion standard cubic feet per day (Bscf/d) of pretreated natural gas, and a base load regasification capacity of 0.5 Bscf/d.

Natural gas will be transported to and from the Terminal via an approximately 86.8-mile-long, 36-inch-outside-diameter (OD) bidirectional pipeline (Pipeline) that is being developed by Oregon Pipeline Company, LLC (Oregon Pipeline; together with LNG Development Company, LLC, Oregon LNG).[1] The Pipeline will interconnect with the interstate transmission system of Northwest Pipeline LLC, a subsidiary of the Williams Companies, at the Northwest Pipeline Interconnect near Woodland, Washington.[2] The Pipeline will be routed through Clatsop, Tillamook, and Columbia counties in Oregon, and Cowlitz County in Washington, as shown on Figure 1. An electrically driven gas compressor station (Compressor Station) will be constructed at milepost (MP) 80.8 of the Pipeline. The Terminal, Pipeline, and Compressor Station are collectively referred to as the Bidirectional Project or Project. Approximately 82 miles of the Pipeline are in Clatsop, Tillamook, and Columbia counties, Oregon, and the remaining approximately 5 miles are in Cowlitz County, Washington.

Refer to the *Applicant-Prepared Draft Biological Assessment* (CH2M HILL, 2013a) for additional project details.

[1] The Terminal and Pipeline are proposed at the site, and along the route, of Oregon LNG's proposed LNG import terminal and pipeline that currently are pending before the Federal Energy Regulatory Commission (FERC) in Docket Numbers CP09-6-000 and CP09-7-000, as amended in Docket Number PF12-18-000.

[2] A separate application has been filed by Northwest for the Washington Expansion Project, a capacity expansion to Northwest Pipeline LLC's existing natural gas transmission facilities along the Interstate 5 corridor in the state of Washington.

SECTION 2.0

Definitions, Avoidance, and Minimization

Avoidance and minimization efforts have been evaluated in the context of both area and wetland function. Definitions used in OAR 141-085 0510 and the Washington State Environmental Policy Act (SEPA) (Chapter 43-21C Revised Code of Washington [RCW]) (Chapter 197-11-768 Washington Administrative Code [WAC]) provided guidance for this project.

> "Mitigation" means the reduction of adverse effects of a proposed project by considering, in the following order:
>
> > (a) Avoiding the effect altogether by not taking a certain action or parts of an action;
> >
> > (b) Minimizing effects by limiting the degree or magnitude of the action and its implementation;
> >
> > (c) Rectifying the effect by repairing, rehabilitating or restoring the affected environment;
> >
> > (d) Reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action by monitoring and taking appropriate corrective measures; and
> >
> > (e) Compensating for the effect by replacing or providing comparable substitute wetlands or other waters.
>
> "Temporary Impacts" are adverse impacts to waters of this state that are rectified within 24 months from the date the impact occurred.
>
> "Temporal Loss" means the loss of the functions and values of waters of this state that occurs between the time of the impact and the time of their replacement through compensatory mitigation.

2.1 Avoidance and Minimization of Area

Oregon LNG avoided wetlands to the greatest extent possible while still providing a Project route that is constructible, yet with minimal impact, and is acceptable to the public and regulatory agencies. Approximately 391 acres of wetlands were identified within the proposed Project area. This includes field evaluated wetlands and those identified with proxy data. Most of the wetlands identified will be avoided. Temporary and permanent impacts proposed will affect approximately 174 acres of the potential wetlands in the study area.

A variety of methods have been implemented during Project design to avoid and minimize impacts to wetlands. Examples of methods are as follows:

- Layout revisions
- Altering the Pipeline route
- Co-alignment with existing easements and rights-of-way
- Crossing the wetlands at the narrowest point possible
- Construction techniques
- Using horizontal directional drilling (HDD) to avoid wetlands

Efforts of wetland avoidance at the Terminal location and along the proposed Pipeline alignment are discussed in Section 3.0. Minimization efforts are discussed in Section 4. 0.

2.2 Methods for Functional Assessments

Wetland site characterization can be generally divided into two major categories: wetland classification and wetland functional assessment. Wetland characterizations generally require both a wetland classification and a functional assessment since the two are inextricably linked to one another. Wetland classification provides the organizational foundation for conducting a functional assessment. Wetland classifications are used to define wetlands in terms of the geographic position and relationships, overall structure, and some of the dynamic processes governing the appearance and function of the classified wetland(s).

Designations for each type of wetland follow the classifications developed by the U.S. Fish and Wildlife Service (USFWS) in *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Referred to as the Cowardin system, this classification is organized based on system, subsystem, and class in a hierarchical structure. The following five systems are used in the classification:

- **Marine:** Open ocean overlying the continental shelf and associated high-energy coastline
- **Estuarine:** Deepwater tidal habitats and adjacent tidal wetlands that are semi-enclosed by land but have open, partly obstructed access to the ocean and are at least occasionally diluted by freshwater runoff
- **Riverine:** Freshwater wetlands contained within a natural or constructed channel that are not dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens
- **Lacustrine:** Freshwater wetlands located in a topographic depression or damned river channel that lack trees, shrubs, or persistent emergents and are larger than 20 acres
- **Palustrine:** Nontidal freshwater wetlands dominated by trees, shrubs, or persistent emergents

Each system, with the exception of palustrine, is then further divided into subsystems based on tidal influences, water depth, or reach of a flowing freshwater system. Systems and subsystems are further divided into classes that describe the general appearance of the wetland in terms of dominant vegetation or the nature and composition of the substrate where vegetative cover is less than 30 percent.

All applications with proposed impact to wetlands must include both a functions and values assessment for the impact site. At this time, the Oregon Department of State Lands (ODSL) uses functional assessment methods by region. The reference-based method, Oregon Rapid Wetland Assessment Protocol (ORWAP), is required for Tidal Waters, Willamette Valley, and all other hydrogeomorphic (HGM) classes. ORWAP is a standardized protocol for rapidly assessing the effectiveness of various wetland functions and their value as determined by the extent of opportunity for using the function and the need for its use in the watershed. ORWAP assesses the effectiveness of 16 functions and the values of these functions, and five other wetland attributes that are most commonly found in wetlands located in Oregon.

ODSL evaluates impacts associated with long linear projects that cross multiple watersheds by fourth field hydrologic unit (HUC). Functional assessments typically use the ORWAP to evaluate wetlands. Wetlands will be grouped by Cowardin class and HGM classification. All tidal or “significant” or high natural resource wetlands, such as palustrine forested wetlands, will be evaluated individually within each fourth field HUC. A summary of these data, by fourth field HUC, for each HGM class of wetland is provided in each of the two wetland delineation reports contained in Appendix 2E of this report.

In the State of Washington, wetlands will be classified according to the USFWS classification system (Cowardin et al., 1979) and the HGM classification system (Brinson, 1993). Wetlands will be qualitatively assessed using the most current version of the *Washington State Wetland Rating System for Western Washington*, developed by the Washington State Department of Ecology (Ecology), which includes updates completed in 2008 (Hruby, 2004. Aerial photographs, Washington Department of Fish and Wildlife (WDFW) priority habitat and species maps, and field observations will be used to complete this rating assessment. The report titled *Wetland Delineation Report for the Oregon LNG Bidirectional Project—Cowlitz County, Washington,* contained in Appendix 2E, will provide the wetland rating forms for the delineated wetlands. For proxy data wetlands that have not been field-accessed, no data are available to complete a rating assessment. When access is granted to these nonsurveyed areas, the wetlands will be qualitatively assessed using the Washington State Wetland Rating System and will be forwarded to the Federal Energy Regulatory Commission (FERC) with the formal wetland delineation under separate cover.

The Ecology wetland rating classifications will be used to determine buffer widths, as required by Cowlitz County under Municipal Code 19.15. Standard buffer widths are established by comparing the wetland rating category and the intensity of land uses proposed on development sites per Tables 19.15.120-A, 19.15.120-B, and 19.15.120-C of Municipal Code 19.15. For Category IV wetlands, the required water quality buffers, per Table 19.15.120-B, are adequate to protect habitat functions. Where applicable, buffers based on the standard widths are not required to extend beyond existing natural or constructed barriers, such as rock outcroppings, dikes, levees, or roads, which isolate the area from the wetland resource.

In areas where access was not granted to the proposed Pipeline easement, wetlands were mapped using proxy data. In these areas, National Wetland Inventory (NWI) mapped wetlands and mapped Natural Resources Conservation Service (NRCS) hydric soils data were used along with the aerial photograph to make a wetland boundary determination. For proxy data wetlands that have not been field accessed, no data are available to complete a functional assessment. When access is granted to these nonsurveyed areas, a functional assessment will be performed and forwarded to FERC with the final filing.

Based on the field data collected and the results of the functional assessment, impacts to high-ranking wetlands were further avoided or minimized to the greatest extent possible. For the purpose of this report, “high-value wetlands” are defined two different ways: large wetlands (greater than 5.0 acres in size) and palustrine forested (PFO) wetlands.

SECTION 3.0

Measures for Wetland Avoidance

Avoidance measures for the Terminal area are outlined in Section 3.3. Avoidance measures along the Pipeline are outlined in Sections 3.5 through 3.13.

3.1 Terminal Features

The Terminal site is situated in the coastal lowlands eco-region and located on the northern portion of the East Bank Skipanon Peninsula (ESP) near the confluence of the Skipanon and Columbia Rivers in Warrenton, Clatsop County, Oregon, at River Mile 11.5 of the Columbia River.

The major components and associated activities at the Terminal are:

- Marine terminal facility including an LNG carrier turning basin in the Columbia River
- Pier with a ship berth for one LNG carrier
- Marine cargo transfer system consisting of three LNG unloading arms, a single vapor return arm, and a single LNG transfer pipeline connected to the onshore facility via a piping trestle
- Three full-containment LNG storage tanks, each with a usable storage capacity of 160,000 cubic meters (m^3)
- LNG spill containment and collection system
- Vaporization, vapor handling, regasification, and sendout systems
- Interconnecting facilities including piping, electrical, and control systems
- Electrical substation at the terminal
- Administrative offices, a control room, and warehouse, security, and other buildings and enclosures
- Utilities, telecommunications, and other supporting systems
- Marine transport to and from the terminal, including docking and un-docking
- Use of tugboats during docking and un-docking maneuvers
- Dredging in the turning basin and disposal of dredged material

The ESP is located north of Harbor Street (also known as Warrenton-Astoria Highway 105) in the City of Warrenton, in Clatsop County, Oregon. Primary access to the general area is provided by U.S. 101. The access road alignment proposed extends from the existing intersection at E. Harbor Street/NE King Avenue, north across the ESP to the Terminal site along a 60-foot-wide right-of-way (ROW) previously platted for NE King Avenue. This access road alignment will also result in fewer environmental impacts than other alternatives because access to the ESP historically has been along this route.

3.2 Terminal—Summary of Wetland Classes

The Terminal site was created from deposition of dredge material beginning in the early 1900s. As a result, the vegetation in this area is immature and lacks unique, complex, or rare habitat features, and the sandy dredge material substrate is vegetated in the low-lying areas with common facultative facultative-wetland, and obligate wetland plants. Wetland classes associated with the Terminal site include estuarine intertidal and PSS classes. Figure 2 shows the extent of estuarine and PSS wetlands affected by the Terminal site plan. The estuarine class of wetlands has been further subdivided by tidal elevation into mudflats, low-marsh, and high-marsh wetlands. These subclassifications correspond to classes used by ODSL to regulate estuarine wetlands in Oregon.

The estuarine class of wetlands has been further subdivided by tidal elevation into mudflats, low-marsh, and high-marsh wetlands. These subclassifications correspond to classes used by ODSL to regulate estuarine wetlands in Oregon. The tidal mud flats and shallow subtidal habitat is the combined intertidal and subtidal habitat lying between the lower edge of the low marsh vegetation line and -6 feet mean lower level water (MLLW). Primary production in this region is dominated by benthic microalgae, which are important for juvenile salmonids. The boundaries of the low marsh were defined as the inshore limit of mean higher-high water (composing the upper boundary) and the lowest extent of areas with greater than 30 percent vegetated cover (composing the lower boundary). Emergent species with dominants, including Lyngbye's sedge (*Carex lyngbyei*), cattail (*Typha latifolia*), Pacific water-parsley (*Oenanthe sarmentosa*), and bulrush (*Scirpus lacustris*), were common in the low marsh. The high marsh boundary is defined on the low side by the mean higher-high water elevation and on the high side by the upper limits of aquatic vegetation. This area does not experience daily inundation but is periodically inundated by higher high tides.

The high-marsh community is characterized by Lyngby's sedge, Pacific silverweed (*Potentilla pacifica*), soft rush (*Juncus effusus*), and velvet grass (*Holcus lanatus)*. Several small patches of shrubs are located in the high marsh.

3.3 Avoidance Measures at Terminal

Construction of the Terminal facilities will affect tidal and nontidal wetlands in the area, resulting in both temporary and permanent impacts to wetlands. Impacts to wetlands associated with the Terminal and related facilities are considered temporary if located within the area disturbed by construction but outside the permanent facility and removal/fill footprint. Impacts to wetlands associated with the Terminal and related facilities are considered permanent if located in the permanent facility or removal/fill footprint. The Terminal's location was selected to minimize the Project's environmental impacts, including high-value wetlands, air emissions, water usage, and potential fisheries resources impacts, by siting the Terminal on land that is appropriately zoned for industrial use, is on an existing deep-water channel, and is relatively close to major natural gas pipeline networks and markets.

The initial conceptual design for the Terminal was a square layout that would have extended the area of fill into the low marsh, mudflats, and shallow sub-tidal areas on the east side of the northern end of the ESP. Subsequent layouts were designed along a north-south axis to avoid these high-value habitats. Estuarine wetlands are considered high-quality wetlands because of their importance to salmonids. There is greater nutrient contribution to the estuary from high and low marshes than from interior palustrine wetlands. Minor modifications to the site layout were made in the spring of 2009, relocating the flare and adjusting the placement of vaporizers to avoid estuarine impacts.

The Terminal was designed and shaped to maximize its footprint in non-tidal areas of the ESP and conversely minimize impacts to tidal waters. For example, the Terminal impacts are above mean higher high tide. The flare for the Terminal was designed to be above the mean higher high tide line, thereby avoiding impacts to low-marsh habitat. After maximizing design considerations, construction of the Terminal and associated facilities will result in permanent loss of wetlands from fill placement. The Terminal footprint includes approximately 1.5 acres that lie within the 100-year floodplain.

Principles used in siting the Terminal facilities included the following:

- Avoiding impacts to low marsh and shallow sub-tidal habitats that have high functional value for salmon
- Maximizing the use of nonwetland area
- Avoiding estuarine wetlands would be more important than avoiding freshwater wetlands

- Using existing roads (Northeast King Avenue) to access the Terminal site
- Demarcating wetlands outside of the construction corridor in the field and identified on work plans as "no work zones" to avoid additional wetland impacts

3.4 Pipeline Features and Summary of Wetland Classes

The Pipeline traverses the Volcanics and Willapa Hills subregions of the Coast Range ecoregion and the Portland/Vancouver Basin subregion of the Willamette Valley ecoregion (Thorson et al., 2003). The Pipeline will be in the Coast Range (MP 0 to MP 82) and Willamette Valley Ecoregions (MP 82 to MP 86.8). These broad divisions represent similarities in geology, topography, and aspects of soils that affect the type of vegetation occurring in these areas.

Wetland classes associated with the Pipeline include Riverine, PSS, and PFO, and PEM.

Construction of the Pipeline will result in short-term disturbances to wetland hydrology, water quality and, where new permanent easement is required, long-term disturbance in the form of functional conversion of forested and scrub-shrub wetlands to emergent wetlands. Oregon LNG has made extensive efforts to locate the additional ATWS at least 50 feet from wetlands and other waterbodies. These extra workspaces are necessary for certain construction techniques for HDD crossings of sensitive features, road crossings, and additional conventional crossings of sensitive environmental features.

3.4.1 Ancillary Features

Ancillary features such as the compressor station, meter stations, and contractor/pipe storage yards will be located to avoid impacts to wetlands.

3.4.2 Access Roads

The study area also includes access roads that intercept with the proposed Pipeline at varying distances along the Pipeline route and include a 50-foot buffer that consists of 25 feet on either side of the centerline of the road. ATWS will be accessed during construction via public road access points, Project access roads and intersection points, and use of the construction easement. Access roads will have minimal impacts on wetlands.

3.5 Avoidance Measures along Pipeline

Oregon LNG conducted vigorous pipeline corridor selection studies to avoid and minimized disturbance to wetlands to the maximum extent possible. Examples of avoidance of wetlands include the following:

- Altering the pipeline route or using HDD to avoid large wetland area
- Avoiding estuarine floodplains by routing behind dike areas
- Shifting pipeline alignment and temporary workspaces to follow existing utility corridor ROW
- Avoiding wetland larger than five acres and with high value PFO wetland
- Routing the pipeline through farmed wetlands that have altered hydrology and lack native vegetation

Wetlands outside of the construction corridor will be demarcated in the field and identified on work plans as "no work zones" to avoid wetland impacts.

Extra work areas will be located at least 50 feet away from wetland boundaries except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land.

3.6 Pipeline Siting Considerations

The first step in identifying pipeline routes was the development of criteria to use in evaluating potential routes. The evaluation criteria relate to public health and safety, environmental constraints, land use, and engineering limitations.

Environmental constraints considered in the evaluation of route alternatives included the following:

- Habitat of protected and endangered species
- Wetlands, streams, rivers, lakes, and other ecologically sensitive areas
- Selected forest stands
- Selected agricultural lands
- Parks, recreation areas, wildlife refuges, and preserves
- Scenic and aesthetic resource areas
- Historic properties and archeological sites
- Landfills and contaminated soil areas

Engineering limitations in the evaluation of route alternatives included the following:

- Urban areas
- Existing utilities
- Highways, roads, and railroads
- Steep slopes, side hills, and rough terrain
- Areas with potential landslides or seismic activity
- Rivers, streams, and other water bodies
- Active, inactive, and future mining areas
- Available construction techniques
- HDD limitations for major crossings
- Bedrock construction methods.

Once the corridor was selected, field studies were conducted to assess wetland, wildlife, fisheries, and cultural resources. Minor variations in the proposed route were examined in response to localized issues identified through the more detailed field surveys and communications with agencies. During preliminary consultations maps of the preferred alignment were reviewed by ODSL, Oregon Department of Fish and Wildlife (ODFW), and USFWS. In addition, ODFW, and USFWS reviewed habitat maps. These reviews led to identifying several dozen wetland and stream crossings for further field review. Inter-agency teams conducted field trips that led to micro-siting (minor route changes) to further avoid or minimize impacts to water resources. In addition, OLNG adopted recommendations to increase the number of HDDs, a construction technique that can be used to avoid impacts sensitive riparian and stream habitats.

3.7 Pipeline Routing—Existing Utility Corridors and Roads

The Pipeline route will be co-located with existing easements and ROWs (e.g., roads, railroads, and utility lines) to the greatest extent practicable.

Oregon LNG demonstrates avoidance by seeking to parallel other linear features or property lines to the extent possible or practical from a pipeline safety perspective. Utilization of existing infrastructure (e.g., highway and road ROWs, utility corridors, or previously developed areas) was one of the most important of the routing criteria. Parallel construction along existing corridors minimizes impacts to additional land owners, reduces clearing of new corridors, and lessens wetland and other natural resource impacts. In addition, operation and maintenance incurred during the life of the pipeline can be reduced when corridors are shared.

3.8 Pipeline—National Wetland Inventory Preplanning

To fill in any potential gaps in mapping, both paper base and electronic National Wetland Inventory (NWI) maps were used. Pipeline alignment and temporary work spaces were sited to minimize disturbance to wetlands to the maximum extent possible.

3.9 Avoidance of High-Value Wetlands

PFO wetlands and wetlands greater than 5.0 acres were evaluated on an individual basis and for purposes of analysis considered to be of high value. Further efforts to avoid or minimize permanent impacts to high-value wetlands consist of sorting the wetlands by their size, Cowardin class, and functional value, and reevaluating the potential for further avoidance or minimization. Wetlands were sorted by the functional assessment ranking assigned to them during field work.

Of the 339 wetlands identified within the Terminal and Pipeline study area, 70 high-value wetlands were identified. With the use of avoidance measures such as route shifts and HDD, Oregon LNG has avoided permanent impacts to 31 high-value wetlands and minimized impacts to 28 high-value wetlands. Table 7-1 in Section 7 of the Conceptual Mitigation Plan identifies all the high-value wetlands and the specific measures taken to further avoid and minimize permanent and temporary impacts.

3.10 Pipeline—Avoidance of Large Wetland Areas

Large wetland areas will be avoided using the HDD construction method. More than 24 acres of high-value wetlands associated with the Adairs Slough in the Lewis and Clark River area will be avoided using the HDD drilling method.

The Pipeline was also aligned so that high-value streams could be crossed at a right angle or crossed using HDD techniques, and avoided completely. Approximately 1.65 miles (27.5 percent) of the area from MP 0 to MP 6 will be constructed using the HDD construction method. Most of this area is behind dikes where there is potential for floodplain restoration, reconnecting historic floodplain to the tidal estuary.

3.11 Locations of Additional Temporary Workspaces

Additional temporary work spaces are associated with HDD and perennial stream crossings. Most will be located 150 feet away from the top of bank of streams which exceeds FERC's minimum standard by 100 feet. ATWS is sited less than 150 feet where the existing zone of forested riparian cover is less than 150 feet or where the risks of erosion are low. ATWS in riparian areas could have an indirect effect on streams or wetlands by increasing the risk of erosion near the wetland or waterbody as a result of land clearing. Extending the distance between ATWS and a wetland or waterbody reduces the risks of sediments eroding into the wetland or waterbody. Additionally, best management practices (BMPs) and erosion control applications outlined in the Wetland Restoration Plan will contribute to reducing risks as well.

3.12 Construction Techniques

Oregon LNG is committed to constructing and operating the proposed Project in a manner that will minimize environmental impacts in compliance with applicable permits and approvals. Efforts will be made before, during, and after proposed mainline Pipeline construction to minimize the extent and duration of Project-related disturbance to wetland resources.

Oregon LNG will employ three different construction procedures to cross waterbodies; all are dry crossing techniques. Intermittent or ephemeral streams lacking water at the time of construction will be crossed using an open trench technique. Perennial streams or streams with water will be crossed with the flume technique whereby the work area is temporarily dammed and stream water is passed through a flume thereby creating a dry work area. The third crossing method is horizontal directional drilling (HDD) whereby the hole is drilled deep under the waterbody and the pipeline is pulled back through the drilled hole.

The HDD method is expensive and only used over long stretches of between 800 and 5,000 feet. The HDD method is not a practical method to avoid all wetland or waterbody impacts. The advantages of HDD methods are minimization of impacts to wetland soils, vegetation, and hydrology. In some cases, such as small wetlands (less than 0.5 acre), HDD methods can potentially result in greater adverse impacts to the surrounding environment. Additional temporary workspace is needed at each HDD site to accommodate the specialized equipment, additional construction crews, and stockpiling materials excavated from entry and exit pits. HDD entry and exit points must also be set back many feet from the wetland so that the required depth of the pipe will be achieved beneath the wetland without bending the pipe in too much over too short of a distance so that it becomes stressed. Excavated material from pits must also be transferred to a temporary workspaces located outside of the wetland. Construction activities for HDD and associated tie-in activities require more time to install pipe per linear foot than the open trench and flume techniques described above. Other disadvantages include additional time spent on construction utilizes more fuel to operate equipment, is more expensive, and extends the time that construction related disturbances (noise, air quality, visual) occur in any given wetland. As mentioned earlier, HDD can also result in a “frac-out” where drilling muds can enter the wetland and require cleanup.

3.13 Construction Access Roads

Further avoidance efforts are demonstrated with the type of access road the project proposes to use. Access to the temporary and permanent Pipeline easement and aboveground facilities will be through existing public and private roads to the extent practical. Where the Pipeline parallels existing utilities, Oregon LNG will use the utility maintenance access roads to the extent practical. Oregon LNG will also use a combination of existing paved, existing gravel, modified gravel, pasture roads, and other conveyances as appropriate.

In general, access roads will lead to the Pipeline approximately every mile along the routes of the Pipeline. Of the access roads to be used for the proposed Project, few existing road need improvements, primarily little more than additional gravel. None of the new access roads are proposed in areas that will cross wetlands or waterbodies. Existing drainage patterns and culverts will be maintained during construction. Erosion and sedimentation controls will be installed at the limits of the access roads where necessary.

Oregon LNG will not construct any new permanent bridges or culverts along the Pipeline routes at stream crossings. During land clearing and construction, streams up to about 30 feet wide will be crossed using temporary bridges. Equipment will be driven around wider crossings. For post-construction maintenance, heavy equipment will not be driven across streambeds. Equipment such as a brush-hog, which may be required for controlling vegetation, will access the Pipelines via the predetermined existing access roads stationed approximately every mile along each route. Should access by a brush-hog type of machine be impractical, clearing as required would be accomplished manually with hand tools.

SECTION 4.0

Measures to Minimize Wetland Impacts

4.1 Terminal Site Layout Alternatives

The main goal in development of the proposed layout was to minimize wetland impacts to the higher quality wetland. The proposed layout was also developed to balance the excavation volume with the fill volume such that imported fill material would be minimized. Estuarine wetlands are higher quality in terms of providing functions for salmonids because of surface water connectivity. There is greater nutrient contribution from estuarine wetlands than from interior palustrine wetlands. The proposed layout has less impact to the estuarine wetland type than the palustrine wetland type.

Oregon LNG developed the proposed layout of the Terminal site layout (shown in Figure 2) after analyzing wetland impacts associated with the original layout. The original site layout was prepared with the LNG storage tanks and process equipment located based on the process flow from the LNG storage tanks to the ambient air vaporizers and then on to the sendout metering station. This alternative layout, which is shown in Figure 3, would likely result in the lowest construction cost for the process facilities, but does not consider wetlands impacts or site grading. The steps involved in modifying the proposed layout in order to minimize wetland impacts included the following:

- The barrier wall around the LNG storage tanks was moved towards the west while keeping the LNG storage tanks in the same location. For both layouts, the tanks are located as far west as allowed by the exclusion zone determined by thermal radiation.
- The LNG vaporizers and flare have been relocated to an area that is slightly higher than the surrounding area and away from existing wetlands to the east and west of the property.
- Although the location of the process area (high pressure LNG pumps and the boiloff gas (BOG) compressor building) is largely driven by process design, it has been moved into an area slightly elevated from the surrounding area that separates existing wetlands in the east and west parts of the property.
- Buildings and utility systems have been located in the southwest corner of the property to minimize access roads and are in areas that are close to the Skipanon River shoreline, away from existing wetlands within the property.

Overall, the current layout has less impact to estuarine and palustrine wetland types than the two prior layouts. Table 2 identifies minimization efforts within the Terminal area. It does not include the pier, access road, or transmission line.

4.2 Pipeline Route Minimization Methods and Alignment Changes

The steps involved in modifying the proposed Pipeline alignment in order to minimize wetland impacts included the following:

- HDD methods will be used to install the proposed Pipeline several feet below the surface of wetlands and streams.
- The Pipeline was aligned parallel or with existing road ROW, utility corridors, or previously disturbed areas.
- The Pipeline route was aligned so that wetlands will be crossed at their narrowest point when possible.

- The Pipeline was aligned so that streams will be crossed at a right angle to their banks in order to minimize negative impacts to riparian areas and streambed.
- The width of the Pipeline ROW will be reduced to 75 feet when crossing nonagricultural wetlands to minimize the area of disturbance.
- Temporary workspaces will be located in areas outside of wetlands to minimize the number of acres of disturbance.
- Minimizing impacts to wetlands did have limitations due to rugged topography, high densities of wetland areas, and a preference to avoid high-quality wetland areas and streams. In areas where a high density of wetlands existed, the proposed Pipeline was aligned in a way that minimized impacts to most wetlands but still crossed some. The Pipeline route was sometimes aligned to cross wetlands with low functional assessment values in order to avoid wetlands with higher values. If Pipeline could be microsited to avoid every wetland, this would increase the overall length of the Pipeline and period of active construction, which could result in more permanent impacts to the landscape and longer periods of temporary disturbance and active construction along the Pipeline route.
- The Pipeline was also aligned so that high-value streams could be crossed at a right angle or crossed using HDD techniques and avoided completely. Approximately 1.65 miles (27.5 percent) of the area from MP 0 to MP 6 will be constructed using the HDD construction method. Most of this area is behind dikes where there is potential for floodplain restoration, reconnecting historical floodplain to the tidal estuary.
- Before final design, Oregon LNG will consider where weight-coating is required between MP 0 and MP 6 in order to make the Pipeline compatible with high water tables or future restoration efforts, and will coordinate with ODFW and other stakeholders to determine whether there are areas with a low water table (i.e., areas not otherwise requiring weight-coating) and which are priority sites for restoration. At this stage in planning, Oregon LNG will consider what reasonable measures could be taken to accommodate future wetland restoration in those drier areas identified as priorities for restoration and where weight-coating would not otherwise be needed.

4.2.1 Routing through Agricultural Wetlands with Previously Impacted Hydrological and Habitat Functions

Some of the wetlands crossed by the proposed Pipeline route are agricultural wetlands. These wetland areas may have wetland hydrology at least seasonally or have altered wetland hydrology (e.g., as a result of drain tiling or irrigation ditches), but do not have wetland or native vegetation due to farming activities where native vegetation is replaced by crops, and therefore provide low quality or only seasonal natural habitat for most species.

Approximately 10.86 miles of wetlands are crossed by the Pipeline route and approximately 2.47miles are agricultural wetlands. No long-term impacts to these wetlands are anticipated because, following construction, these areas will be restored to their preconstruction topographical and hydrological patterns, and will be allowed to return to their preexisting agricultural practices. This process will result in no net loss of wetland acreage within the proposed Pipeline corridor. Oregon LNG will follow the construction procedures and mitigation measures in Section VI.A.d of the *FERC Wetland and Waterbody Construction and Mitigation Procedures Modified by Oregon LNG* (FERC Procedures; CH2M HILL, 2013b) related to standard upland protective measures, including workspace and topsoil requirements, as they apply to these agricultural wetlands. The width of the ROW will not be reduced to 75 feet in agricultural wetlands.

No compensatory mitigation other than soil restoration is planned for features identified as Agricultural Wetlands in Oregon. During discussion with ODSL in November 2007 (see Resource Report 1—General Project Description, Appendix 1K), it was indicated that ODSL and USACE will regulate wetlands in agricultural areas based on their definitions of farmed or previously converted wetlands. However, following Pipeline construction in these areas, restoration of soils is expected to be adequate compensation for temporary impacts.

4.2.2 Reduced Construction Easement Area

Oregon LNG will make every effort to maintain a reduced construction easement width of 75 feet in wetlands, in accordance with the FERC Procedures. Agricultural wetlands are not included in this width restriction. During construction, vegetation will be manually cleared throughout the entire 75-foot construction easement. There will be no grubbing, and the root systems will be left intact except for an approximately 10-foot-wide area directly over the pipe trench. This swath will be grubbed in preparation for trenching and pipe placement. Work within the 75-foot construction easement will be conducted on mats where wetland soils are wet at time of construction to minimize impacts to vegetation and to minimize soil compaction.

Buffers will be clearly marked in the field during construction activities. Operation of construction equipment in wetlands will be limited to that needed to clear the easement, dig the trench, fabricate the pipe, install the pipe, backfill the trench, and restore the easement.

4.2.3 Locations of Temporary and Additional Temporary Workspaces

The FERC Procedures require ATWS to be located at least 50 feet outside identified wetland boundaries, except where the adjacent uplands consist of actively cultivated or rotated cropland or other disturbed land.

During discussions with USFWS and National. Marine Fisheries Service (NMFS) for this proposed Project, it was agreed that (unless approved by USFWS, NMFS, and ODFW) ATWS will be set back 150 feet from wetlands and streams. In addition, overnight parking of vehicles, storage of fuels and other hazardous materials, and refueling activities will take place no closer than 150 feet from a wetland or a stream, unless full containment of potential contaminants is provided. Under certain clearly defined conditions, and subject to agency approval, ATWS may be placed closer to wetlands or waterbodies where the ATWS placement will not increase impacts to streams or fish habitat. BMPs and erosion control applications outlined in the Wetland Restoration Plan will be implemented to reduce risk of sediments entering the waterbodies.

SECTION 5.0

Unavoidable Impacts to Wetlands

The Project proposes approximately 174 acres of temporary and permanent wetland impacts. Table 3 identifies wetlands with proposed permanent Cowardin class change by subbasin and milepost. The wetlands HGM class, proposed area, and acres of impact are listed.

Avoidance of some wetlands was not feasible due to Project constraints. These constraints include:

- Large wetland complexes spanning several acres not entirely avoidable
- HDD method not feasible for small wetlands due to greater overall environmental impacts
- Orientation of sensitive stream crossings prevented complete avoidance of adjacent wetlands
- Preference to use existing utility and road ROW resulted in greater impacts to wetlands

5.1 Terminal

Construction of the Terminal, pier, and entry road will affect estuarine and nontidal wetlands in the area, resulting in both temporary and permanent impacts to wetlands. Siting of the proposed Terminal has gone through several iterations in an effort to avoid impacts to high-quality wetlands. Of the 114.74 acres of wetlands identified within the Terminal study area, approximately 35.00 acres of permanent and 2.34 acres of temporary impacts would result from activities associated with construction and operation of the Terminal. Table 4 shows temporary and permanent wetland impacts at the Terminal.

5.1.1 Temporary Impacts

Impacts to wetlands associated with the Terminal and related facilities are considered temporary if they were within the area disturbed by construction but outside the permanent facility and removal/fill footprint.

The Terminal and related facilitates would temporarily impact approximately 02.34 acre of jurisdictional nontidal wetlands and 0.0.00 acre of tidal waters of the U.S. and the State of Oregon. In accordance with state and federal regulatory requirements, Oregon LNG will offset all temporary loss of wetland function and values by restoring functions to the impacted area upon completion.

5.1.2 Permanent Impacts

Permanent impacts to wetlands associated with the Terminal and related facilities include 3.46 acres of jurisdictional nontidal wetlands and 31.57 acres of tidal waters. The impacts were quantified as permanent if they were in the permanent facility or removal/fill footprint. For permanent Terminal impacts, Oregon LNG intends to provide offsite compensatory mitigation.

5.2 Pipeline

Construction of the proposed Pipeline will result in short-term disturbances to wetland hydrology, water quality, and, where new permanent easement is required, long-term disturbance in the form of functional conversion of forested wetlands to scrub-shrub wetlands within the 10-foot maintenance corridor. Impacts to wetlands associated with the proposed Pipeline construction and operation were quantified based on the proposed activity in temporary construction and permanent operation zones. Of the approximate 276 acres of wetlands identified within the Pipeline study area, approximately 18 acres of permanent and 118 acres of temporary impacts would result from activities associated with construction and operation of the Pipeline. Tables 5 and 6 show temporary and permanent wetland impacts associated with the pipeline.

5.2.1 Temporary Impacts

The route alignment of the Pipeline would temporarily impact approximately 118 acres of jurisdictional wetlands. Table 5 identifies temporary wetland impacts associated with the construction activities of the Pipeline.

5.2.2 Temporary Construction Zones

When constructing the proposed Pipeline through the wetlands, the only soil excavation will occur at the Pipeline trench area, which will be about 10 feet wide, depending on depth of pipe. Temporary fill will occur adjacent to the trench where soil and plant materials from the trench will be stockpiled.

During construction, vegetation will be hand-cleared throughout the entire 75-foot construction easement. This swath will be grubbed in preparation for trenching and pipe placement. Work within the 75-foot construction ROW will be conducted on mats to minimize soil compaction and minimize impacts to vegetation. Following construction, all wetlands will be rehabilitated to preconstruction soil and hydrology conditions, and revegetated.

As a result, the following assessment of Project *construction* impacts can be made for the 75-foot-wide construction corridor:

- All impacts to wetlands will be short-term and temporary throughout the construction easement (e.g., reestablishment of vegetation beginning within days or weeks of cessation of site work), with the exception of the trench excavation area.
- In the estimated 10-foot wide trench area, impacts will be longer-term, and temporary and herbaceous wetlands will recover more slowly as a result of clearing, grubbing, and soil excavation.

5.3 Permanent Impacts

The route alignment for the Pipeline would permanently change the Cowardin class for 18 acres along the Pipeline route, but no changes would occur along access roads. Table 6 identifies permanent impacts.

During operations, a 30-foot-wide area within the 50-foot-wide permanent easement will be routinely maintained at a maximum frequency of once every 3 years. This area will be maintained free of trees over 15 feet tall. A 10-foot-wide mow strip will be located within the 30-foot-wide maintained area and centered over the proposed Pipeline. This mow strip will be maintained annually in a nonwoody or treed condition to allow line-of-sight for aerial surveys. The result of Pipeline wetland crossings will be temporary impacts to all wetland types during construction throughout the entire 75-foot construction; permanent Cowardin class change of PSS and PFO to PEM in the 10-foot mow strip; and a permanent Cowardin class change of PFO to PSS in the 30-foot-wide maintained area, excluding the 10-foot mow strip.

5.4 Wetlands Affected by Permanent Cowardin Class Change

Approximately 391 acres of wetlands were identified in the entire project area. Permanent unavoidable impacts consist of approximately 53 acres of wetlands. Within the Pipeline project area, the permanent impacts (18 acres) do not reflect a net loss of wetland, but rather a change to the wetland’s Cowardin class from PFO to PSS or PEM.

SECTION 6.0

Best Management Practices

The construction schedule will consider the recommended ODFW in-water work periods unless an extension of those work periods is granted. The start and end dates are variable depending on the region and the stream; start dates can begin as early as June 1 and end dates are as late as October 15.

The construction schedule will also consider biological patterns to minimize potential impacts to species and habitats, specifically, BMPs will include the following:

- Work in the Lower Columbia River Estuary will be timed to take advantage of seasonal low and high tides.
- Land clearing will begin between May 15 and June 1, after the end of the rainy season.
- A cover crop (in nonagricultural areas) will be planted and erosion control implemented prior to the rainy season following land clearing.
- Riparian areas will be cleared the same year in which the Pipeline is constructed. Riparian areas will be kept intact when land is cleared a year in advance of construction.
- Work timing will be coordinated with the biological needs of special-status species. For example, no harvesting of trees in riparian areas will occur until migratory bird species have completed nesting activities, after August 15 and before April 15, unless biological surveys indicate the absence of nesting.
- Vegetation clearing will take advantage of the dry season.
- Revegetation will focus on the cool, rainy season.

6.1 Clay Plugs

Where the Pipeline trench may drain a wetland (steep slopes), clay plugs will be constructed or the trench bottom will be sealed as necessary to maintain the original wetland hydrology.

6.2 Soil Segregation

Oregon LNG will segregate the topsoil up to 1 foot deep over the area disturbed by trenching in wetlands where hydrologic conditions permit this practice, and this topsoil will be placed in the trench at the end of backfilling of trench spoils once the trench is backfilled. In accordance with the FERC Procedures, restoration and monitoring of wetland crossings will be conducted to help ensure successful wetland revegetation. Oregon LNG will abide by additional wetland construction methods, monitoring, and restoration as required by the FERC Procedures.

6.3 Rehabilitation of Wetlands Temporarily Impacted by the Project

The rehabilitation/restoration plan is proposed for all the acres of temporary wetland impacts. Rehabilitation of the Pipeline construction corridors to preconstruction wetland conditions will involve:

- Topsoil segregation and replacement
- Topsoil management to maintain viability of seedbank and vegetative propagules
- Reconstruction of grades
- Permanent erosion control seeding with native wetland species
- Seedbed preparation where soils are displaced or compacted by equipment

6.3.1 Soil Segregation

For the trench excavation area, natural revegetation with native species will be encouraged by providing suitable soil conditions and applying salvaged topsoil from cleared trench area; weed-infested topsoil will not be reapplied. Proper topsoil stockpile procedures (aeration, moisture, and shading) will ensure that viable plant propagation sources (e.g., viable seeds, rhizomes, roots, spores, fungi) are replaced following construction in the trench area. Temporary erosion control seeding with sterile wheat grass will be used to stabilize soil until natural revegetation occurs.

6.3.2 Seeding and Revegetation

The wetland areas temporarily impacted by vegetation clearing, equipment traffic, and material storage outside the trench area will be rehabilitated by reestablishing wetland vegetation from seedbank germination and vegetative propagation via resprouting of liveroots and propagules left intact and protected during construction. Sterile wheat grass cover will be used to temporarily stabilize soil until natural germination occurs. In some instances, a permanent native wetland seed mix will be applied to ensure adequate cover of the site by desirable species. The seeding and planting mixtures recommended by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for Oregon will be used as a basis for developing a Project-specific seed mixture. Measures will be taken to control the spread of noxious weeds.

For natural regeneration of temporarily cleared forested wetlands outside the 10-foot-wide maintenance corridor, the following actions will be taken:

- Where feasible, vegetation will be cut during winter months when the plants are in senescence.
- Work crews will minimize damage to stumps (especially stumps less than 10 inches in diameter that are most capable of vegetatively reproducing) and to root stock left after vegetation clearing.
- To reduce injury to viable roots and shoots, construction traffic will be managed to reduce areas 1) affected by soil compaction and rutting; 2) supported by mats, pallets, or other ground pressure dissipaters in moist or wet soils; and 3) characterized by low ground pressure equipment where terrain allows.
- Woody debris, chipped woody vegetation, and unmerchantable logs greater than 12 inches will be salvaged for surface application outside the 10-foot-wide maintenance corridor where existing downed wood is insufficient.
- Various site specific seed mixes will be used for temporary erosion control seeding to avoid conflicts with the permanent cover.
- Where compatible with preconstruction woody species, seeds of native woody wetland species will be incorporated into permanent erosion control seed mixes.
- After construction if annual monitoring indicates that disturbed wetland areas are not successfully revegetating with desirable woody plants, supplemental planting will be undertaken.

6.3.3 Monitoring and Adaptive Management Plan

The project proposes a 10-year monitoring period after construction activities to evaluate the rejuvenation of vegetation in the temporary and permanent wetland impact areas. If the annual monitoring report indicates that disturbed areas are not successfully revegetating with wetland herbaceous or woody plants similar to preconstruction conditions, supplemental seeding or planting will be undertaken. Woody species used for replanting would resemble local reference conditions.

The Monitoring and Adaptive Management Plan consists of a 10-year monitoring period with the following conditions:

- Monitoring of vegetation establishment that consists of vegetation transect or transects, depending on size of wetlands that detail herb, shrub, and tree aerial cover at radii of 3 feet, 15 feet, and 30 feet, respectively
- Percent of planted materials surviving, classified by condition (e.g., vigorous, living, stressed)
- Percent cover for the following four classes: native forbs and grasses, non-native forbs and grasses, shrubs and trees, and bare ground and rock
- Report on invasive vegetation, vandalism, dumping, wildlife damage, or other conditions actually or potentially harmful to the restoration
- Identify maintenance concerns (e.g., plants need to be replaced).
- Color photograph that shows the restoration site, taken from a fixed photo point (or points depending on size of wetland) drawn on a map of the restoration area, keyed to lines of sight from those photo points

6.3.4 Restoring Grading

Restoration and cleanup will begin after the trench is backfilled. The disturbed areas will be graded as closely as practical to preconstruction contours. During cleanup, trash that remains in the easement will be removed and disposed of in approved areas in accordance with applicable regulations. Organic refuse unsuitable for spreading over the easement will be disposed of at an authorized facility. Disturbed areas will be restored as closely as practical to their original condition, permanent erosion control measures will be installed as appropriate, and revegetation measures will be implemented. In addition, line markers will be installed directly above the buried Pipelines in accordance with 49 CFR 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards,* Subpart M, "Maintenance," 192.707.

SECTION 7.0

Conclusions

Wetlands were considered throughout the development of the proposed Project. Efforts will be made before, during, and after proposed Pipeline construction to avoid and minimize the extent and duration of Project-related disturbance to wetland resources and compensate for disturbance to wetlands where limitations exist. Past and proposed actions and results are summarized as follows:

- Numerous stages of planning and review have been implemented to avoid and minimize impacts to wetlands. The first step was to identify Pipeline routes and then evaluate these potential routes. Extensive review of environmental constraints, public health and safety, land use, and engineering constraints limited the number of potential Pipeline routes. Once the corridor was selected, field studies were conducted to assess wetland, wildlife, fisheries, and cultural resources. Based on these studies, more than 40 Pipeline revisions were made to avoid and minimize impacts to these resources wherever it was feasible.
- Of the approximate 391 acres of wetlands identified in the project area, approximately 53 acres are proposed for permanent impacts. Within the Pipeline project area, the permanent impacts (18 acres) do not reflect a net loss of wetland but rather a change to the wetland's Cowardin class from PFO to PSS.
- During operations, a 30-foot-wide area within the 50-foot-wide permanent easement will be routinely maintained at a maximum frequency of once every 3 years. This area will be maintained free of trees over 15 feet tall. A 10-foot-wide mow strip will be located within the 30-foot-wide maintained area and centered over the proposed Pipeline. The 10-foot-wide mow strip will be maintained annually in a nonwoody or treed condition to allow line-of-sight for aerial surveys.
- Oregon LNG developed multiple strategies to minimize impacts where wetlands could not be avoided due to several limitations. These include rugged topography, high densities of wetland areas, and a preference to avoid high-quality wetland areas and streams. Strategies to minimize Project-related impacts to wetlands include maintaining a reduced construction easement width of 75 feet in wetlands and set back ATWS 150 feet from wetlands and streams in nonagricultural wetlands.
- Further revisions to the proposed Project were made after consultation with ODFW, USFWS, and ODSL. These revisions included additional techniques to avoid impacts to high-quality wetlands that include co-locating the Pipeline route with existing ROWs, using existing access routes, altering and adding additional HDD sites, and slightly moving the Pipeline alignment and Terminal layout.
- Oregon LNG will also be implementing BMPs to rehabilitate impacted wetlands to preconstruction conditions. These practices include installation of clay plugs to maintain original hydrology of wetlands, segregation of soils during construction, grade wetlands to preconstruction contours, and revegetate wetlands with appropriate native vegetation. A final quality control exercise will be conducted to ensure maximum avoidance and minimization to wetlands has occurred. For permanent, unavoidable impacts to wetlands, Oregon LNG intends to purchase mitigation credits, provide onsite or offsite compensatory mitigation, or participate in an in-lieu fee program.

During the planning phase, extensive methods and tactics have been considered, prescribed, and incorporated as features of the Project's design to ensure that resultant and unwanted disturbances to wetlands are avoided and minimized.

SECTION 8.0

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Tables

TABLE 1

Summary of Wetland Acreage and Wetland Impacts

Wetland Acreage in Study Area[a]		Acreage of Temporary Impacts		% of Temporary Impacts in Study Area	Acreage of Permanent Impacts	% of Permanent Impacts in Study Area	Total Wetland Impacts in Study Area		% of Total Wetland Impacts in Study Area
	Acres		**Acres**		**Acres**			**Acres**	
Terminal	114.74	Terminal	2.34	2.04%	35.02	30.52%	Terminal	37.36	32.56%
Pipeline (mainline)	276.06	Pipeline	118.36	42.87%	18.1	6.56%	Pipeline	136.46	49.43%
Total	390.80	Total	120.70	30.89%	53.12	13.59%	Total	173.82	44.48%

[a] Terminal includes facility area, dock and pier, entry road, and water/wastewater facilities.

TABLE 2

Permanent Wetland Impacts Associated with Terminal Site Layouts[a]

Wetland Type	Impacted Area (acres)		
	Original Terminal Layout	Terminal Layout in FERC Submittal October 2008	Current Terminal Layout
Estuarine[b]	22.4	19.1	27.6
Palustrine[c]	0.6	4.1	5.3
TOTAL	23	23.2	32.9

[a] Wetland impacts are from the onshore Terminal facilities only and do not include impacts from the entry road, transmission line, or pier.

[b] Impacts to Estuarine wetlands include Mud Flat, Low Marsh, and High Marsh habitat types as classified by the Oregon Department of Fish and Wildlife.

[c] Impacts to Palustrine wetland include Interior Freshwater habitat type as classified by the Oregon Department of Fish and Wildlife.

TABLE 3

Summary of High-Value Wetland Impacts

Wetland ID	Study Area	Milepost	4th HUC- Subbasin	HGM Class	Cowardin Class	Size (Acres)	Permanent Class Change Acres	Temporary (No Class Change) Acres	Total Impact Acres
Pipeline									
W99CL0021	Pipeline	0.8	Lower Columbia	Estuarine and Marine Wetland	E2USN	23.39	0.00	11.29	11.29
W40CL001	Pipeline	2.7	Lower Columbia	TBD	PSS	8.05	0.00	3.88	3.88
W40CL002	Pipeline	2.9	Lower Columbia	TBD	PFO	1.84	0.41		0.41
W40CL003	Pipeline	3	Lower Columbia	TBD	PFO	0.34	0.07		0.07
W99CL033	Pipeline	3.7	Lower Columbia	TBD	PFO	1.20	0.53		0.53
W99CL077A	Pipeline	3.7	Lower Columbia	TBD	AW	6.23	0.00	3.34	3.34
W5BCL042F	Pipeline	4.2	Lower Columbia	TBD	AW	8.82	0.00	5.42	5.42
W42CL001	Pipeline	4.5	Lower Columbia	TBD	PEM	7.17	0.00	5.07	5.07
W5BCL073	Pipeline	4.5	Lower Columbia	TBD	PFO	0.07	0.00		0.00
W40CL018	Pipeline	5	Lower Columbia	TBD	PFO	0.72	0.10		0.10
W39CL009	Pipeline	5.1	Lower Columbia	TBD	PFO	0.11	0.09		0.09
W1BCL001	Pipeline	7.9	Lower Columbia	Slope	PFO	1.22	0.36		0.36
W39CL005	Pipeline	11	Lower Columbia	TBD	PFO	0.86	0.24		0.24
W39CL007	Pipeline	11	Lower Columbia	TBD	PFO	0.44	0.12		0.12
W39CL012	Pipeline	11.1	Lower Columbia	TBD	PFO	0.26	0.09		0.09
W1BCL012	Pipeline	18.6	Lower Columbia	Riverine	PFO	0.22	0.13		0.13
W1BCL014	Pipeline	18.6	Lower Columbia	Flats	PFO	0.84	0.34		0.34
W1BCL015	Pipeline	18.9	Lower Columbia	Slope	PFO	0.09	0.03		0.03
W1BCL016	Pipeline	19	Lower Columbia	Slope	PFO	0.04	0.00		0.00
W1BCL018	Pipeline	19	Lower Columbia	Slope	PFO	0.01	0.01		0.01
W1BCL021	Pipeline	19.3	Lower Columbia	Slope	PFO	0.14	0.00		0.00
W2BCL008	Pipeline	19.6	Lower Columbia	Riverine	PFO	0.95	0.30		0.30
W7BCL006	Pipeline	22.4	Lower Columbia	Slope	PFO	0.16	0.08		0.08
W6BCL003	Pipeline	22.5	Lower Columbia	Riverine	PFO	0.23	0.10		0.10
W3BCL101	Pipeline	36.3	Nehalem	TBD	PSS/PFO	1.98	1.00		1.00
W3BCL100	Pipeline	36.5	Nehalem	TBD	PSS/PFO	0.53	0.15		0.15
W3BCL101b	Pipeline	36.7	Nehalem	TBD	PSS/PFO	10.58	5.41		5.41
W3BCL003	Pipeline	37.1	Nehalem	Slope	PFO	0.72	0.10		0.10

TABLE 3

Summary of High-Value Wetland Impacts

Wetland ID	Study Area	Milepost	4th HUC- Subbasin	HGM Class	Cowardin Class	Size (Acres)	Permanent Class Change Acres	Temporary (No Class Change) Acres	Total Impact Acres
Pipeline									
W3BCL002	Pipeline	37.2	Nehalem	Slope	PFO	0.06	0.05		0.05
W1BCL050A	Pipeline	39.6	Nehalem	Slope	PFO	1.69	0.78		0.78
W8BCL007B	Pipeline	41	Nehalem	TBD	PFO	0.74	0.23		0.23
W8BCL011A	Pipeline	41.4	Nehalem	TBD	PFO	0.07	0.02		0.02
W8BCL011B	Pipeline	41.5	Nehalem	TBD	PFO	0.65	0.18		0.18
W8BCL012	Pipeline	41.6	Nehalem	Depressional	PFO	0.50	0.15		0.15
W8BCL013	Pipeline	41.7	Nehalem	Depressional	PFO	0.37	0.14		0.14
W8BCL018	Pipeline	42.3	Nehalem	Riverine	PFO	1.30	0.48		0.48
W1BCL044	Pipeline	43.4	Nehalem	Slope	PFO	0.56	0.12		0.12
W1BTI001	Pipeline	44.2	Nehalem	Riverine	PFO	0.31	0.12		0.12
W6BCO004	Pipeline	47.6	Nehalem	Riverine	PFO	0.13	0.06		0.06
W3BCO111	Pipeline	50.6	Nehalem	Slope	PFO	0.22	0.14		0.14
W3BCO112	Pipeline	50.8	Nehalem	Slope	PFO	0.31	0.14		0.14
W3BCO100	Pipeline	57.7	Nehalem	TBD	PFO	0.39	0.13		0.13
W3BCO102	Pipeline	63.5	Nehalem	Slope	PFO	0.65	0.25		0.25
W3BCO010	Pipeline	63.7	Nehalem	Depressional	PEM/PFO	0.25	0.06		0.06
W6BCO005	Pipeline	69.1	Nehalem	Riverine	PFO	0.46	0.25		0.25
W3BCO007	Pipeline	72.9	Lower Willamette	Depressional	PFO	0.40	0.34		0.34
W1BCO023	Pipeline	73.5	Lower Willamette	Riverine	PFO	0.26	0.12		0.12
W6BCO002	Pipeline	74.6	Lower Willamette	Riverine	PFO	1.64	0.73		0.73
W6BCO001	Pipeline	74.9	Lower Willamette	Riverine	PFO	0.12	0.04		0.04
W3BCO013	Pipeline	76.4	Lower Columbia - Clatskanie	Riverine	PEM/PFO	0.35	0.10	0.04	0.14
W3BCO117	Pipeline	79.1	Lower Columbia - Clatskanie	Slope	PFO	0.90	0.33		0.33
W5BCO013	Pipeline	81.5	Lower Columbia - Clatskanie	Riverine	PFO	1.85	1.24		1.24
W99CO003	Pipeline	81.6	Lower Columbia- Clatskanie	Freshwater Forested/Shrub Wetland	PFO	0.27	0.06		0.06

TABLE 3

Summary of High-Value Wetland Impacts

Wetland ID	Study Area	Milepost	4th HUC- Subbasin	HGM Class	Cowardin Class	Size (Acres)	Permanent Class Change Acres	Temporary (No Class Change) Acres	Total Impact Acres
Pipeline									
W99CO006	Pipeline	81.8	Lower Columbia - Clatskanie	TBD	PFO	0.95	0.27		0.27
W99CO007	Pipeline	81.8	Lower Columbia - Clatskanie	Freshwater Forested/Shrub Wetland	PFOC	0.37	0.37		0.37
W99CW001	Pipeline	82.7	Lower Columbia - Clatskanie	Riverine	PEM	5.37	0.00	1.35	1.35
W99CW002	Pipeline	83	Lower Columbia - Clatskanie	Freshwater Emergent Wetland	PEMC	35.21	0.00	17.96	17.96
W6BCW001	Pipeline	84.2	Lower Columbia - Clatskanie	Depressional	PEM	7.64	0.00	3.85	3.85
W99CW007	Pipeline	84.9	Lower Columbia - Clatskanie	Freshwater Emergent Wetland	PEMC	11.34	0.00	6.48	6.48
W99CW005	Pipeline	83.0 (HDD Pullback)	Lower Columbia - Clatskanie	Freshwater Forested/Shrub Wetland	PFOA	0.32	0.32		0.32
					Total	**152.88**	**16.88**	**58.68**	**75.55**
Terminal									
W4BCL05	Terminal	Terminal	Lower Columbia	Tidal	EEM	45.97	22.33	4.41	26.74
W4BCL06	Terminal	Terminal	Lower Columbia	Tidal	EEM	7.56	0.00	0.01	0.01
W4BCL07	Terminal	Terminal	Lower Columbia	Tidal	EEM	19.75	0.02	0.49	0.51
W5BCL084	Terminal	Terminal	Lower Columbia	Depressional	PFO	0.02	0.00		0.00
W5BCL085	Terminal	Terminal	Lower Columbia	Depressional	PFO	0.44	0.26		0.26
W99CL0001	Terminal	Terminal	Lower Columbia	TBD	PFO	0.04	0.00		0.00
W99CL0002	Terminal	Terminal	Lower Columbia	Freshwater Forested/Shrub Wetland	PFO/SSC	0.43	0.07		0.07
W99CL0006	Terminal	Terminal	Lower Columbia	TBD	PFO	0.23	0.11		0.11
W99CL0007		Terminal	Lower Columbia	Freshwater Forested/Shrub Wetland	PFOA	1.01	0.89		0.89

TABLE 3

Summary of High-Value Wetland Impacts

Wetland ID	Study Area	Milepost	4th HUC- Subbasin	HGM Class	Cowardin Class	Size (Acres)	Permanent Class Change Acres	Temporary (No Class Change) Acres	Total Impact Acres
Pipeline									
W99CL0009		Terminal	Lower Columbia	TBD	PFO	0.10	0.01		0.01
					Total	**75.53**	**23.70**	**4.91**	**28.61**

TBD = Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined.

TABLE 4

Temporary and Permanent Wetland Impacts—Terminal

Terminal Component	HUC4 Sub-basin	HGM Code	Impact Type	EEM	PEM	PEM/SSC	PEMC	PFO	PFO/SSC	PFOA	PSS	Grand Total
Terminal												
Entry Road	Lower Columbia	Depressional	PERM	0.00	0.92	0.00	0.00	0.16	0.00	0.00	0.03	**1.11**
			TEMP	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.01	**0.63**
		Depressional Total		0.00	1.54	0.00	0.00	0.16	0.00	0.00	0.04	**1.74**
Entry Road Total				0.00	1.54	0.00	0.00	0.16	0.00	0.00	0.04	**1.74**
Facility Area	Lower Columbia	Depressional	PERM	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	**0.55**
		Depressional Total		0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	**0.55**
		TBD	PERM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	**0.72**
		TBD Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	**0.72**
		Tidal	PERM	27.57	0.49	0.00	0.00	0.00	0.00	0.00	3.49	**31.55**
		Tidal Total		27.57	0.49	0.00	0.00	0.00	0.00	0.00	3.49	**31.55**
Facility Area Total				27.57	1.03	0.00	0.00	0.00	0.00	0.00	4.21	**32.81**
Pier	Lower Columbia	Tidal	PERM	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
		Tidal Total		0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
Pier Total				0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
Water/Wastewater Components	Lower Columbia	Depressional	TEMP	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	**0.79**
		Depressional Total		0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	**0.79**
		Freshwater Emergent Wetland	TEMP	0.00	0.00	0.03	0.22	0.00	0.00	0.00	0.00	**0.25**
		Freshwater Emergent Wetland Total		0.00	0.00	0.03	0.22	0.00	0.00	0.00	0.00	**0.25**
		Freshwater Forested/Shrub Wetland	PERM	0.00	0.00	0.00	0.00	0.00	0.07	0.89	0.00	**0.97**
		Freshwater Forested/Shrub Wetland Total		0.00	0.00	0.00	0.00	0.00	0.07	0.89	0.00	**0.97**
		TBD	PERM	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	**0.12**
			TEMP	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.03	**0.66**
		TBD Total		0.00	0.63	0.00	0.00	0.12	0.00	0.00	0.03	**0.78**
Water/Wastewater Components Total				0.00	1.42	0.03	0.22	0.12	0.07	0.89	0.03	**2.79**
Grand Total				27.59	3.99	0.03	0.22	0.28	0.07	0.89	4.28	**37.37**
Total Nontidal - Permanent												**3.46**
Total Nontidal - Temporary												**2.34**
Total Tidal - Permanent												**31.57**
Total Tidal - Temporary												**0**

TBD = Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined.

TABLE 5

Construction Temporary Wetland Impacts—Mainline and Ancillary Facilities

4th HUC	HGM	AW	E1UBL	E2USN	PEM	PEM/PFO	PEMC	PSS	PSSC	Grand Total
Mainline										
Lower Columbia	Depressional	2.00	0.00	0.00	6.33	0.00	0.00	1.85	0.00	10.18
	Estuarine and Marine Deepwater	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.24
	Estuarine and Marine Wetland	0.00	0.00	11.29	0.00	0.00	0.00	0.00	0.00	11.29
	Flats	0.00	0.00	0.00	0.81	0.00	0.00	0.11	0.00	0.92
	Riverine	0.00	0.00	0.00	0.82	0.00	0.00	1.00	0.00	1.82
	Slope	0.00	0.00	0.00	0.60	0.00	0.00	0.55	0.00	1.15
	TBD	32.99	0.00	0.00	8.46	0.00	0.00	4.19	0.00	45.64
Lower Columbia Total		34.99	0.24	11.29	17.01	0.00	0.00	7.70	0.00	**71.23**
Lower Columbia - Clatskanie	Depressional	0.00	0.00	0.00	4.45	0.00	0.00	0.00	0.00	4.45
	Freshwater Emergent Wetland	0.00	0.00	0.00	0.00	0.00	27.64	0.00	0.00	27.64
	Freshwater Forested/Shrub Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.83
	Riverine	0.00	0.00	0.00	1.46	0.04	0.00	0.19	0.00	1.69
	Slope	0.00	0.00	0.00	0.33	0.00	0.00	0.48	0.00	0.81
	TBD	0.14	0.00	0.00	2.27	0.00	0.00	0.00	0.00	2.40
Lower Columbia - Clatskanie Total		0.14	0.00	0.00	8.50	0.04	27.64	0.67	0.83	**37.82**
Lower Willamette	Depressional	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.12
Lower Willamette Total		0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	**0.12**
Nehalem	Depressional	0.00	0.00	0.00	1.29	0.00	0.00	0.97	0.00	2.26
	Flats	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.04
	Freshwater Forested/Shrub Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.46
	Riverine	0.00	0.00	0.00	1.16	0.00	0.00	0.01	0.00	1.17
	Slope	0.00	0.00	0.00	2.17	0.00	0.00	0.00	0.00	2.17
	TBD	2.73	0.00	0.00	0.16	0.00	0.00	0.19	0.00	3.08
Nehalem Total		2.73	0.00	0.00	4.83	0.00	0.00	1.64	0.00	**9.19**
Mainline Total		37.85	0.24	11.29	30.33	0.04	27.64	10.13	0.83	**118.36**

Access Roads- Permanent Impacts		
4th HUC	HGM	Grand Total
N/A	N/A	No Impacts
Contractor/Storage Yards- Permanent Impacts		
4th HUC	HGM	Grand Total
N/A	N/A	No Impacts

N/A = not applicable.

TBD = Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined.

TABLE 6

Permanent Impacts—Mainline and Ancillary Facilities

4th HUC	HGM	PEM/PFO	PFO	PFOA	PFOC	PSS	PSS/PFO	PSSC	Grand Total
Mainline- Permanent Cowardin Type Changes									
Lower Columbia	Flats	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.34
	Riverine	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.66
	Slope	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.49
	TBD	0.00	1.65	0.00	0.00	0.00	0.00	0.00	1.65
Lower Columbia Total		0.00	3.14	0.00	0.00	0.00	0.00	0.00	**3.14**
Lower Columbia - Clatskanie	Freshwater Forested/Shrub Wetland	0.00	0.06	0.32	0.37	0.00	0.00	0.36	1.12
	Riverine	0.10	1.24	0.00	0.00	0.22	0.00	0.00	1.56
	Slope	0.00	0.33	0.00	0.00	0.43	0.00	0.00	0.76
	TBD	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.27
Lower Columbia - Clatskanie Total		0.10	1.90	0.32	0.37	0.65	0.00	0.36	**3.70**
Lower Willamette	Depressional	0.00	0.34	0.00	0.00	0.07	0.00	0.00	0.42
	Riverine	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.89
Lower Willamette Total		0.00	1.24	0.00	0.00	0.07	0.00	0.00	**1.31**
Nehalem	Depressional	0.06	0.29	0.00	0.00	0.00	0.00	0.00	0.35
	Riverine	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.91
	Slope	0.00	1.57	0.00	0.00	0.00	0.00	0.00	1.57
	TBD	0.00	0.56	0.00	0.00	0.00	6.56	0.00	7.12
Nehalem Total		0.06	3.33	0.00	0.00	0.00	6.56	0.00	**9.95**
Mainline Total		0.16	9.60	0.32	0.37	0.73	6.56	0.36	**18.10**

Access Roads- Permanent Impacts		
4th HUC	HGM	Grand Total
N/A	N/A	No Impacts
Contractor/Storage Yards- Permanent Impacts		
4th HUC	HGM	Grand Total
N/A	N/A	No Impacts

N/A = not applicable.

TBD = Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined.

Figures

Figure 1

Project Location Map

OregonLNG

LEGEND

- Terminal Location
- Northwest Pipeline Interconnect
- Compressor Station
- Freeways and Highways
- Pipeline Route
- Northwest Pipeline
- Rivers and Lakes
- Cities
- County Boundary

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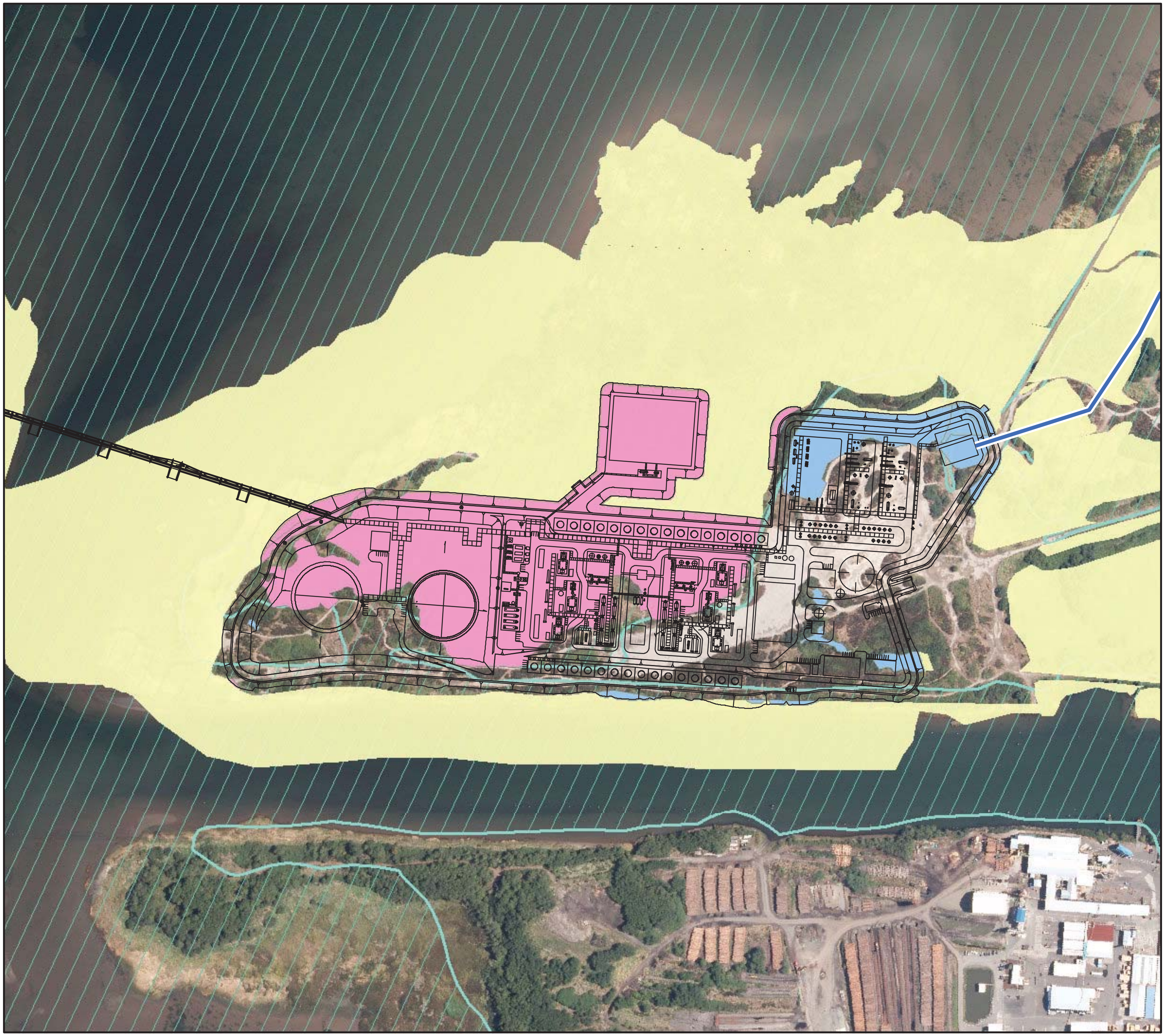


Figure 2

Terminal Layout
Wetland Disturbance

OregonLNG

LEGEND

Pipeline Route

Wetlands

Temporary and Permanent Wetland Disturbance

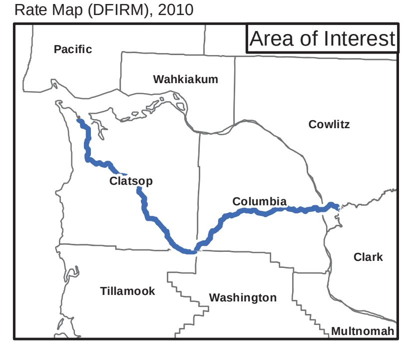
Estuarine (27.6 Acres)

Palustrine (5.3 Acres)

100-Year Floodplain

Note:
Impacts encompass the permanent footprint for Terminal operation and the temporary footprint for construction. The Terminal water/wastewater lines and wastewater pump station are not included. See Resource Report 2, Appendix 2F, for a specific breakdown of Terminal wetland impacts.

Source: FEMA Digitial Flood Insurance Rate Map (DFIRM), 2010



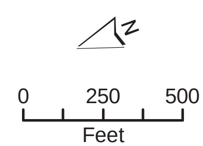


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Figure 3
Alternative Terminal Site Layout

OregonLNG

LEGEND

Pipeline Route

Wetlands

Permanent Wetland Disturbance

Estuarine (22.3 Acres)

Palustrine (0.5 Acres)

0 250 500
Feet

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Appendix F
Channel Response Matrix for Pipeline Crossings of Endangered Species Act Streams

Channel Response Matrix for Pipeline Crossings of Perennial Endangered Species Act Streams

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DATE: May 16, 2013

Introduction

This technical memorandum presents the results of a high-level stream channel assessment and scour analysis for the waterbodies crossed by the Oregon Pipeline. Oregon LNG proposes to construct and operate the Oregon Pipeline and associated LNG terminal. The Oregon Pipeline consists of approximately 86.8 miles of 36-inch-diameter pipeline to be constructed between Warrenton, Oregon, and Woodland, Washington, crossing three counties, Clatsop, Columbia, and Cowlitz. The pipeline will cross numerous intermittent and perennial streams and rivers. Specific scour analyses and migration studies may be performed at a later date for specific crossings as required by Oregon LNG and/or permitting agencies.

This stream channel assessment combines an evaluation of channel morphology and channel-forming processes to simplify a wide variety of channels into a manageable analysis framework. Channel segments (subreach units) are areas of streams that respond to disturbances in a similar fashion based on similarities in channel-forming processes. The assessment of channel conditions provides a context for evaluating the influence of changes in land management or activities on channel conditions and processes. Major changes in channel morphology (scour) are caused by changes in discharge, sediment supply, and vegetation in the channel. The scour analysis focuses on fluvial-dominated stream channels and provides a first-cut method of identifying stream crossings with a potential for vertical and/or lateral scouring (i.e., lateral channel migration).

Methods

Streams with perennial flow regimes and supporting Federal Endangered Species Act (ESA)-listed salmonids were evaluated to determine which pipeline crossings have a predisposition for vertical scouring or lateral migration. A total of 120 streams crossed by the Oregon Pipeline have perennial flow regimes, support ESA-listed salmonids, or have designated critical habitat. Twenty-four of those streams support ESA-listed salmonids or have designated critical habitat. Although some intermittent and ephemeral drainages not supporting ESA-listed salmonids will require further investigation prior to final engineering design, these sites were not included at this time for this study.

Stream segment slope (gradient) and channel confinement provide a useful orientation for stream classification and provide a method to distinguish between the possible responses of a stream channel to disturbances. Channel confinement is the ratio of the valley or floodplain width to the channel width.

Stream slope at potential pipeline crossings was determined from field reconnaissance surveys. Where field reconnaissance surveys were not conducted, channel gradient was determined from 1:24,000 U.S. Geological Survey (USGS) topographic maps by measuring the distance between a contour line upstream and a contour line downstream of the crossing, or by using Washington 10-meter Digital Elevation Model (DEM) elevations. Channel confinement was determined by measuring the valley width or floodplain (distance between contour lines on either side of the channel at the crossing based on a 1:24,000 USGS topographic map) and comparing this width to the channel width (ordinary high water [OHW] width).

After determining channel gradient, channel confinement, and valley width at Pipeline crossings, streams were grouped into categories based on their similarities and channel characteristics. Streams with specific similarities are expected to have similar responses to disturbances or be predisposed to specific conditions. These responses or conditions are based in part on the Washington Department of Natural Resources (DNR) Watershed Assessment Methodology (1994) Channel Response Matrix. This approach is also consistent with previous pipeline projects in the area that have included multiple waterbody crossings. In addition, the Rosgen channel type (Rosgen, 1996), which was identified by channel characteristics collected during field reconnaissance surveys, was used to verify and support DNR Channel Response Matrix characteristics.

Ephemeral drainages (defined as streams with flows generated by periodic surface runoff along the Pipeline route were not analyzed for scour events. Ephemeral drainages, as defined in the assessment method, only flow during and shortly after a large precipitation event and lack the hydrological and morphological characteristics of a perennial or intermittent stream. Ephemeral drainages may not have a well-defined channel and may be vegetated. Therefore, ephemeral drainages are not considered to have vertical or lateral scour potential. However, ephemeral drainages could experience mass wasting events, such as landslides or slope failure, which could affect the pipeline. Landslide and slope failure potential along the Pipeline are further evaluated in Resource Report 6 — Geologic Resources.

In addition to ephemeral drainages, non-ESA intermittent streams were also excluded as they are primarily minor waterways with generally lower scour risk. However, as discussed above, they may still experience mass wasting events that could affect the pipeline.

According to Rosgen (1996) and personal communication with Janine Castro of the U.S. Fish and Wildlife Service (Castro, 2009), only streams with a gradient of less than 4 percent typically have the potential for significant lateral scouring at the reach level. Streams with a greater than 4 percent gradient have no functional floodplain and therefore have no, or little, potential for lateral channel migration at the reach scale.

At ESA stream crossings and within Federal Emergency Management Agency floodways, the pipeline will be buried at a depth that minimizes the risk of exposure from vertical scour and channel migration. The actual depth of the pipeline will be determined during final engineering to address risks of vertical scour and channel migration.

Results

Stream channels with similar characteristics are expected to respond to disturbances similarly or be predisposed to specific events. Channel slope can be used as a surrogate for stream energy, which is the dominant aspect controlling channel morphology. Channel confinement controls the characteristics of potential channel responses and manifests the long-term history of a valley (DNR, 1994). Increased entrenchment is one possible channel response to disturbance. Entrenchment is defined as the vertical containment and the degree to which a channel is incised in the valley floor (DNR, 1994).

Channel slope and confinement are general indicators of a stream’s transport capacity and the balance between sediment supply and transport capacity (DNR, 1994). The Channel Response Matrix provides a simple method for categorizing potential channel responses in terms of gradient and channel confinement and is based on geomorphic reasoning and professional experience. The matrix differentiates between fluvial and mass-wasting dominated channels. Twenty percent channel slope typically defines the upper limit of fluvially dominated channel systems (DNR, 1994).

The DNR Channel Response Matrix shows a channel’s predisposition to specific events given specific channel characteristics. These characteristics are based on channel slope, channel confinement, and valley width. The potential channel responses based on these characteristics include fine sediment deposition, bank erosion, wood loss, debris flow scour, and debris flow deposition. Channel reaches can be grouped into source, transport, and response reaches using gradient as the criterion. Reaches greater than 20 percent gradient are considered source reaches, 3 to 20 percent gradient are transport reaches, and less than 3 percent gradient are response reaches.

Six gradient groupings are used to generally correspond to gradients associated with changes in channel morphology that reflect relative transport capacity and the response potential (DNR, 1994).

The 24 streams evaluated using this methodology were categorized into six distinct groups based on slope, channel width, and confinement (Table 1). Table 2 (located at the end of this technical memorandum) provides specific stream crossing ID numbers, stream slope (gradient %), valley width, confinement, and vertical and/or lateral scour potential for each of the 24 ESA perennial streams.

TABLE 1
Channel Response Matrix for Pipeline Crossings of Perennial Waterbodies and Streams Supporting ESA-listed Salmonids

	Scour Potential of Evaluated Stream Crossings (Vertical/Lateral)					
Channel Type	**None (at Reach Scale)/Slight**	**Slight/Moderate**	**Moderate/Severe**	**Moderate to Severe/None**	**Severe/None**	**Severe (Mass Wasting Dominated)/None**
Valley Width (VW) > 4 Channel Width (CW) (Unconfined)	11	3	7	1		
2 CW < VW < 4 CW (Moderately Confined)	1					
VW < 2 CW (Confined)	1					
Gradient and Typical Channel Bed Morphology						
Channel Gradient Percentage (Stream Type)	< 1 (Pool-Riffle)	1 to 2 (Pool-Riffle, Plane-Bed)	2 to 4 (Plane-Bed, Forced Pool-Riffle)	4 to 8 (Step-Pool)	8 to 20 (Cascade)	> 20 (Colluvial)

Source: DNR, 1994.

Notes: Valley width (VW) = distance between first contour lines on either side of channel (1:24,000 scale USGS). Channel width (CW) = OHW channel width.

Based on DNR (1994) Standard Watershed Analysis Methodology, six channel types with the potential for either lateral (bank erosion causing channel migration) and/or vertical (debris flow) scour potential were identified for streams being crossed by the pipeline. Of the 24 perennial/ ESA stream crossings, 11 possess some potential for vertical scouring or debris flow events, while 23 have at least some potential for lateral channel migration.

Unconfined channels with slopes less than 1 percent (11 streams) are associated with:

- Fine sediment deposition
- Bank erosion
- Wood accumulation

Unconfined channels with slopes between 1 and 2 percent (3 streams) are associated with:

- Wood loss
- Scour potential
- Fine sediment deposition
- Bank erosion

Unconfined channels with slopes between 2 and 4 percent (7 streams) are associated with:

- Dam break flood
- Debris flow deposition
- Bank erosion
- Coarse sediment deposition
- Scour potential
- Wood loss

Unconfined channels with slopes between 4 and 8 percent (1 stream) are associated with:

- Debris flow scour/debris flow deposition
- Dam break flood
- Wood loss

Moderately confined channels with slopes less than 1 percent (1 stream) are associated with:

- Fine sediment deposition
- Bank erosion
- Wood accumulation

Confined channels with slopes less than 1 percent (1 stream) are associated with:

- Coarse sediment deposition
- Wood loss

Ten of the evaluated waterways will be crossed via horizontal directional drilling (HDD). Of these 10 crossings, one (Bear Creek) has more than a slight vertical scour potential. Of the remaining nine HDD crossings, all have no vertical scour potential and have a slight lateral scour potential. The remaining crossing has a severe lateral scour potential (Bear Creek).

This high-level method of scour potential determination relies exclusively on gradient, valley width, and channel width, excluding additional factors such as substrate type. For certain waterways, historical observation and empirical evidence suggest that the scour potential may be different than that estimated by this model. In these cases, engineering will determine the accurate depth for the pipe crossing.

Conclusions

Of the 24 perennial ESA streams being crossed by the pipeline, 11 have a slight or higher potential for vertical scouring. Of these, eight have a moderate or higher potential for vertical scouring. One channel has a severe potential for vertical scouring, and eight channels are mass-wasting dominated (MWD). The only stream with moderate/severe vertical scour potential is an intermediate waterway. Seven of the MWD streams are classified as intermediate, with the one remaining classified as minor. Thirteen streams have no vertical scour potential. Of the streams evaluated, five are considered major streams (100 feet or greater in width as defined by the Federal Energy Regulatory Commission's *Wetland and Waterbody Construction and Mitigation Procedures* [2003]), none of which have a slight or higher potential for experiencing vertical scouring flows (no vertical scour potential).

One crossing (Little Clatskanie River) has no or negligible potential for lateral channel migration (lateral scouring) at the reach scale, 13 have a slight potential, 3 have a moderate potential, and 7 have a severe potential for lateral channel migration. Of the seven streams with a severe potential for lateral scour, all are intermediate waterbodies. The five major stream crossings have a slight potential for lateral channel migration. Potential for vertical scour and channel migration will be used to inform engineers which streams require special attention regarding depth of pipeline during final design.

Literature Cited

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TABLE 2
Oregon Pipeline Crossings of Perennial ESA Streams

Stream ID	MP at Crossing	Crossing Method	Flow Regime	Waterbody Type	Waterbody	Valley Width (ft)[a]	OHW Width (ft)	Channel Confinement[b]	Gradient (%)[c]	Vertical Scour Potential[d]	Lateral Channel Migration Potential[e]
S99CL001	1.0	HDD	Perennial	Major	Adairs Slough	5,258	110	Unconfined	<1	None	Slight
S5BCLo74	1.5	HDD	Perennial	Intermediate	Vera Creek	4,960	20	Unconfined	<1	None	Slight
S40CL002	3.1	HDD	Perennial	Major	Lewis and Clark River	5,808	1250	Unconfined	<1	None	Slight
S5BCL064	4.5	Dry/Flume	Perennial	Intermediate	Barrett Slough	3,844	12	Unconfined	<1	None	Slight
S99CL064	5.7	HDD	Perennial	Major	Lewis and Clark River	2,261	340	Unconfined	<1	None	Slight
S1BCL001	7.9	Dry/Flume	Perennial	Intermediate	Heckard Creek	1,139	10	Unconfined	<1	None	Slight
S99CL018	11.0	HDD	Perennial	Intermediate	Lewis and Clark River	1,365	35	Unconfined	<1	None	Slight
S2BCL008A	25.4	Dry/Flume	Perennial	Intermediate	Little Fishhawk Creek	104	15	Unconfined	<1	None	Slight
S2BCL008B	31.4	Open cut	Perennial	Intermediate	Alder Creek	421	15	Unconfined	3.6	Moderate	Severe
S99CL108	33.5	HDD	Perennial	Major	Nehalem River	3,601	120	Moderately Confined	<1	None	Slight
S8BCL005	41.0	Open cut	Perennial	Intermediate	Rock Creek	470	20	Unconfined	2.2	Moderate	Severe
S1BCL021	43.1	Dry/Flume	Perennial	Intermediate	South fork Rock Creek	2,302	15	Unconfined	3.0	Moderate	Severe
S1BCL022	43.4	HDD	Perennial	Intermediate	Bear Creek	436	12	Unconfined	2.3	Moderate	Severe
S6BCO002	47.5	Dry/Flume	Perennial	Intermediate	North Fork Wolf Creek	143	30	Unconfined	1.0	Slight	Moderate
S3BCO012	50.5	Dry/Flume	Perennial	Intermediate	Clear Creek	780	30	Unconfined	2.1	Moderate	Severe
S3BCO107	55.7	Dry/Flume	Perennial	Intermediate	Cedar Creek	976	10	Unconfined	1.6	Slight	Moderate
S3BCO101	57.7	HDD	Perennial	Intermediate	Rock Creek	1,157	30	Unconfined	<1	None	Slight
S3BCO014	63.8	HDD	Perennial	Intermediate	Nehalem River	113	30	Moderately Confined	<1	None	Slight
S99CO020	70.7	Open cut	Perennial	Intermediate	Clatskanie River	219	19	Unconfined	<1	None	Slight
S5BCO001	71.8	Open cut	Perennial	Minor	Little Clatskanie River	244	2	Unconfined	4	Moderate/Severe	None
S3BCO010	73.0	Open cut	Perennial	Intermediate	Milton Creek	317	12	Unconfined	3.2	Moderate	Severe
S3BCO018	76.4	Open cut	Perennial	Minor	Merril Creek	376	1	Unconfined	1.1	Slight	Moderate
S99CO011	81.6	Open cut	Perennial	Intermediate	Deer Island Slough	780	38	Unconfined	2.1	Moderate	Severe
S99BCO014	82.4	HDD	Perennial	Major	Columbia River	5,637	3300	Confined	<1	None	Slight

[a] Valley width (VW) = distance between first contour lines on either side of channel (1:24,000 scale U.S. Geological Survey).

[b] Channel confinement based on Channel Response Matrix (Table E-2) in DNR (1994):

VW > 4CW = Unconfined
2CW < VW < 4CW = Moderately Confined
VW < 2CW = Confined

[c] Where gradient not field collected, used 1:24,000 USGS topographic maps. Gradient listed as 0.0% means gradient < 1%.

[d] For vertical scour potential, “None” means on a reach scale. There will still likely be pool scour etc.

[e] Lateral channel migration potential based on DNR (1994):

TABLE 2
Oregon Pipeline Crossings of Perennial ESA Streams

Stream ID	MP at Crossing	Crossing Method	Flow Regime	Waterbody Type	Waterbody	Valley Width (ft)[a]	OHW Width (ft)	Channel Confinement[b]	Gradient (%)[c]	Vertical Scour Potential[d]	Lateral Channel Migration Potential[e]

None = Could be microbank erosion but not lateral channel migration.
Slight = Unconfined or moderately confined channel with gradient < 1%.
Moderate = Unconfined or moderately confined channel with gradient 1% - 2%.
Severe = Unconfined or moderately confined channel with gradient 2% - 4%.
Stream ID = stream identification number
ft = feet
MP = milepost

Appendix G
Drawings of Typical
Non-ESA-Listed Stream Crossings

EROSION AND SEDIMENT CONTROL KEYED NOTES

1. PERENNIAL, INTERMITTENT, AND EPHEMERAL STREAMS BETWEEN 0 AND 30 FEET WIDE WITH FLOW, WILL BE CROSSED USING WATER DIVERSION TECHNIQUES. STREAM FLOW WILL BE DIVERTED FROM THE ACTIVE CONSTRUCTION AREA USING A FLUME PIPE(S). THE PIPELINE WILL BE TRENCHED IN UNDERNEATH THE FLUME PIPE(S). STREAM DIVERSION TECHNIQUES ARE PRESENT IN DETAIL 10.
2. FOR INTERMITTENT AND EPHEMERAL STREAMS THAT ARE DRY AT THE TIME OF CONSTRUCTION, THE PIPELINE WILL BE INSTALLED USING AN OPEN CUT METHOD. THIS CONSTRUCTION METHOD WILL ADHERE TO THE TIME RESTRICTIONS LISTED IN GENERAL NOTE 6. AT THE COMPLETION OF PIPE INSTALLATION AT THIS TYPE OF CROSSING THE WATERBODY WILL BE RETURNED TO PRECONSTRUCTION CONTOURS. SEE DETAIL 11.
3. HORIZONTAL DIRECTIONAL DRILLING TECHNIQUES WILL BE USED TO CROSS WATERBODY. SPOILS FROM THE DRILLING WILL BE STOCKPILED AT LEAST 50 FEET FROM THE WATERBODY. SEE DETAIL 12.
4. CROSSINGS AT DRY WETLANDS WHERE SOILS ARE STABLE ENOUGH TO SUPPORT EQUIPMENT WITHOUT SINKING (E.G., MINERAL HYDRIC SOILS), WILL EMPLOY UPLAND CONSTRUCTION TECHNIQUES (TRENCHING AND BACKFILLING). A REDUCED CONSTRUCTION EASEMENT OF 75 FEET WILL BE ADHERED TO. TOP SOIL WILL BE SEGREGATED, AND NO STABILIZATION MATTING WILL BE USED. EXCESSIVE RUTTING FROM CONSTRUCTION VEHICLES WILL BE AVOIDED.
5. TIMBER MATS WILL BE USED TO SUPPORT CONSTRUCTION EQUIPMENT AT WETLAND CROSSINGS WHERE SOILS ARE TOO WET TO SUPPORT CONSTRUCTION VEHICLES. A REDUCED CONSTRUCTION EASEMENT OF 75 FEET WILL BE USED. TOPSOIL WILL NOT BE SEGREGATED.
6. TIMBER MATS (ONLY ENOUGH FOR ONE TRACTOR) WILL BE USED TO SUPPORT CONSTRUCTION EQUIPMENT AT WETLAND CROSSINGS WHERE STANDING WATER IS PRESENT IN THE WETLAND. PULL/ PUSH TECHNIQUES WILL BE IMPLEMENTED TO MINIMIZE THE DISTURBANCE. A REDUCED CONSTRUCTION EASEMENT OF 75 FEET WILL BE ADHERED TO. SPOILS WILL BE TEMPORARILY PLACED NEXT TO THE EXCAVATION AND BACKFILLED IMMEDIATELY AFTER PIPE HAS BEEN INSTALLED.
7. HORIZONTAL DIRECTIONAL DRILLING TECHNIQUES WILL BE USED TO CROSS WETLAND. SPOILS FROM THE DRILLING WILL BE STOCKPILED AT LEAST 50 FEET FROM THE WETLAND.
8. LIMIT CLEARING OF VEGETATION TO THE TEMPORARY AND PERMANENT EASEMENTS. PLACE HIGHLY VISIBLE CONSTRUCTION FENCING AROUND THE PERIMETER OF SENSITIVE AREAS (INCLUDING WETLANDS) THAT ARE NOT TO BE DISTURBED DURING CONSTRUCTION.
9. CONSTRUCTION STAGING AREAS WILL BE A MINIMUM OF 50 FEET AWAY FROM THE EDGE OF WATERBODIES AND WETLANDS.
10. INSTALL SILT FENCE ALONG THE DOWNGRADIENT EDGE OF TEMPORARY STAGING AREAS AND DOWNGRADIENT OF LAND DISTURBING ACTIVITIES ADJACENT TO WATERBODIES. SEE SILT FENCE DETAIL 18. SILT FENCE SHALL BE INSTALLED PRIOR TO LAND DISTURBING ACTIVITIES. SILT FENCE INSTALLATION WILL CONFORM WITH STANDARD CONSTRUCTION PRACTICES, INCLUDING BEING PROPERLY KEYED IN, OVERLAPPING SECTIONS, AND WILL LOOP OVER ON ITSELF.
11. INSTALL TEMPORARY SEDIMENT BARRIER ACROSS THE ENTIRE WATERBODY DOWNGRADIENT OF THE PIPELINE CROSSING PRIOR TO REMOVAL OF THE FLUME PIPE(S) TO CAPTURE FIRST FLUSH OF SEDIMENT THROUGH THE DISTURBED CONSTRUCTION AREA. REMOVE TEMPORARY SEDIMENT BARRIER ONCE TURBIDITY WITHIN THE DISTURBED AREA IS NO LONGER OBSERVED. SEE DETAIL 14.
12. (NOT USED)
13. EXCAVATED SPOILS WILL BE STOCKPILED AT LEAST 50 FEET FROM THE EDGE OF THE WATERBODY. STOCKPILED MATERIAL WILL BE LEFT WITH STABLE SLOPES, AND WILL BE COVERED WITH A THICK LAYER OF MULCH OR PLASTIC SHEETING AT THE END OF EACH WORK DAY, OR DURING PERIODS OF PRECIPITATION. SEE PLASTIC SHEETING DETAIL 15.
14. INSTALL SILT FENCE OR STRAW WATTLES AROUND THE PERIMETER OF STOCKPILED MATERIALS (SPOILS AND VEGETATION)
15. TRENCH PLUGS WILL BE INSTALLED AT ALL WATERBODY CROSSINGS, AS NECESSARY, TO PREVENT DIVISION OF WATER INTO UPLAND PORTIONS OF THE PIPELINE TRENCH AND KEEP ACCUMULATED TRENCH WATER OUT OF THE WATERBODY. SEE TRENCH PLUG DETAIL 13.
16. WHERE STREAM FLOW IS DIVERTED AROUND THE ACTIVE CONSTRUCTION AREA, TEMPORARY RIPRAP WILL BE PLACED AT THE OUTLET OF THE PIPE OR FLUME, AS NEEDED, TO PREVENT SCOUR. ALL TEMPORARY RIPRAP MATERIAL WILL BE REMOVED AT THE COMPLETION OF STREAM FLOW DIVERSION. SEE OUTLET PROTECTION DETAIL 25.
17. STABILIZE DISTURBED RIPARIAN AREAS WITHIN 24 HOURS WITH TEMPORARY SEED MIX (TRITICUM AESTIVUM X ELYTRIGIA ELONGATA – REGREEN [STERILE WHEATGRASS HYBRID] AT 60 KG/HA), ALONG WITH A SOIL BINDER, SOIL TACKIFIER, AND MULCH.
18. SHAPE AND STABILIZE STREAM BANKS WITHIN 24 HOURS IN PREPARATION FOR STREAM BANK RESTORATION AS SHOWN IN APPENDIX E, TABLE E-1.
19. (NOT USED)
20. INSTALL EROSION CONTROL MATTING TO STABILIZE STREAM BANKS OR DISTURBED SLOPES AS SHOWN IN TABLE APPENDIX E, TABLE E-1.
21. INSTALL TURF REINFORCEMENT MATS TO STABILIZE STREAM BANKS OR DISTURBED SLOPES AS SHOWN IN TABLE APPENDIX E, TABLE E-1.
22. INSTALL ROOTWAD REVETMENTS TO STABILIZE STREAM BANKS AS SHOWN IN TABLE APPENDIX E, TABLE E-1.
23. REPAIR ANY GULLIES FORMED ON ELONGATED SLOPES OF STREAM BANKS USING LIVE BRANCH CUTTINGS AND COMPACTED SOIL AS SHOWN IN APPENDIX E, TABLE E-1.
24. TEMPORARILY STABILIZE EXISTING BARE SOIL AREAS BY SPREADING STRAW MULCH AND CRIMPING INTO THE SURFACE. THE APPLICATION RATE FOR STRAW MULCH IS 2,500 LBS PER ACRE. PERMANENTLY SEED THE DISTURBED UPLAND AREAS WITH THE APPROVED NATIVE SEED MIX.

EROSION AND SEDIMENT CONTROL KEYED NOTES (CONTINUED)

25. ALONG THE PIPELINE EASEMENT, FORESTED WETLANDS WILL BE REHABILITATED TO MAINTAIN AN HERBACEOUS, SCRUB—SHRUB, AND SMALL TREE STATE.
26. (NOT USED)
27. INSTALL STRAW WATTLES ON DISTURBED SLOPES ACROSS THE ENTIRE CONSTRUCTION EASEMENT. INSTALL STRAW WATTLES PERPENDICULAR TO THE SLOPE. SEE STRAW WATTLE DETAIL 17. STRAW WATTLE SPACING IS DEPENDENT ON SLOPE AS FOLLOWS:

SLOPE	MINIMUM SPACING
<6:1	50 FEET
6:1 – 4:1	25 FEET
4:1 – 2:1	20 FEET
2:1 – 1:1	10 FEET

28. INSTALL TEMPORARY SEED MIX (TRITICUM AESTIVUM X ELYTRIGIA ELONGATA – REGREEN [STERILE WHEATGRASS HYBRID] AT 60 KG/HA), ALONG WITH A SOIL BINDER, SOIL TACKIFIER, AND MULCH ON DISTURBED SLOPES.
29. INSTALL LIVE STAKE VEGETATION, AND PERMANENT SEED MIX ON DISTURBED SLOPES.
30. RESEED UPLAND AREAS DISTURBED BY CONSTRUCTION TRAFFIC (RUTTING) OR USED AS TEMPORARY STAGING AREAS AT THE COMPLETION OF THE PIPE CROSSING WITH A NATIVE SEED MIX.

LANDSLIDE AND DEBRIS FLOW KEYED NOTES

A. INSTALL SUBSURFACE ROCK NEXT TO OUTSIDE BEND OF STREAM BETWEEN TOE OF SLOPE WHERE CONSTRUCTION EASEMENT CROSSES STREAM AND OUTSIDE LIMITS OF STREAM TO PREVENT BANK UNDERCUTTING. SEE DETAIL 26 FOR SUBSURFACE ROCK SIZE AND EXTENT.

B. INSTALL SLOPE BREAKS CONSISTING OF LOGS EMBEDDED IN SOIL ON DISTURBED SLOPES, PERPENDICULAR TO DIRECTION OF SLOPE AND ACROSS CONSTRUCTION EASEMENT. SEE SLOPE BREAK DETAIL 20. SLOPE BREAK SPACING IS DEPENDENT ON SLOPE AS FOLLOWS:

SLOPE	MINIMUM SPACING
4:1 – 3:1	40 FEET
3:1 – 2:1	20 FEET
>2:1	10 FEET

C. (NOT USED)

D. INSTALL DRAINAGE TRENCH AND PIPING WITHIN DISTURBED SLOPE, PERPENDICULAR TO DIRECTION OF LNG PIPELINE, AND ACROSS CONSTRUCTION EASEMENT. SEE DRAINAGE TRENCH AND PIPING DETAIL 21.

E. INSTALL DIVERSION DITCHES ON DISTURBED SLOPES, PARALLEL TO DIRECTION OF SLOPE, WHERE DOWNHILL END OF DIVERSION DITCH TERMINATES AT A SLOPE BREAK (DETAIL 20), SEE DETAIL 28.

F. CONSTRUCT ROCK BUTTRESS AT TOE OF SLOPEGREATER THAN 4:1, OUTSIDE LIMITS OF STREAM, WHERE TOE OF SLOPE IS LOCATED WITHIN 100 FEET OF LIMITS OF STREAM . SEE TOE BUTTRESS DETAIL 19.

G. INSTALL ROCK CHECK DAM, SEE DETAIL 27.

GENERAL NOTES

1. THE PREDOMINANT SOIL TYPE IN THE AREA IS PRONE TO WATER EROSION. THEREFORE THE IMPLEMENTATION OF EROSION CONTROL PRACTICES MUST BE AN INTEGRAL PART OF ALL ASPECTS OF CONSTRUCTION.
2. THE IMPLEMENTATION OF THESE EROSION CONTROL PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADE OF THESE BMPS IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED, APPROVED, AND THE SITE IS STABILIZED.
3. THE EROSION AND SEDIMENT CONTROL BMPS SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS, DURING THE ACTIVE CONSTRUCTION PERIOD, THESE EROSION AND SEDIMENT CONTROL BMPS SHALL BE MAINTAINED AND UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT LADEN WATER DOES NOT ENTER RECEIVING WATERBODIES.
4. BMPS WILL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS AND GOOD ENGINEERING PRACTICES. BMPS WILL BE MAINTAINED IN EFFECTIVE OPERATING CONDITIONS.
5. THE EROSION CONTROL MEASURES SHOWN IN THESE PLANS MUST BE CONSTRUCTED IN CONNECTION WITH ALL CLEARING AND GRADING ACTIVITIES AND IN SUCH A MANNER TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DOES NOT ENTER THE RECEIVING WATERBODIES, OR IS TRACKED ONTO PAVED ROADS.
6. CONSTRUCTION ACTIVITIES WILL BE SCHEDULED SO THAT THE PIPELINE TRENCH IS EXCAVATED IMMEDIATELY PRIOR TO PIPE-LAYING ACTIVITIES. THE DURATION OF CONSTRUCTION WILL BE LIMITED TO 3 DAYS ACROSS FISH BEARING STREAMS.
7. VEHICLE FUELING AND EQUIPMENT FUELING AREAS WILL BE LOCATED IN A DESIGNATED AREA 150' AWAY FROM PERENNIAL STREAMS.
8. PRIOR TO ANY LAND-DISTURBING ACTIVITIES FOR STREAM, WETLAND, OR OTHER CROSSINGS A CONSTRUCTED ENTRANCE AND EXIT FROM THE PAVED ROAD WILL BE CONSTRUCTED, TO REDUCE TRACKING OF SEDIMENT ONTO PAVED ROADS.
9. RETURN WATERBODY CROSSINGS TO PRECONSTRUCTION CONTOURS, OR TO A STABLE ANGLE OF REPOSE.
10. REMOVE ALL NON-NATIVE MATERIALS FROM THE CROSSING AFTER CONSTRUCTION AND FINAL STABILIZATION ARE COMPLETE.
11. TYPICAL DETAILS ARE PROVIDED IN ATTACHMENT 1d-1 OF THE SUPPLEMENTAL FERC FILING DATED AUGUST 6, 2009.
12. REFERENCES IN THESE KEYED NOTES TO APPENDIX E, TABLE E-1, PERTAIN TO THE BIOLOGICAL ASSESSMENT FILED WITH FERC ON MAY 13, 2009.

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY	APVD

DSGN R SMETANA | DR J PFEIFER | CHK M BRICKER | APVD XXX

SCALE: NONE
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 — 1"
IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

LEGEND
- TWS (TEMPORARY WORK SPACE)
- ATWS (ADDITIONAL TEMPORARY WORK SPACE)
- WETLAND BOUNDARY
- COUNTY LINE
- PERMANENT EASEMENT LINE
- ALIGNMENT PI (POINT OF INTERSECTION)
- EDGE OF ROADWAY
- ROADWAY CENTERLINE
- CITY LIMIT LINE
- PROPERTY LINE
- FLOWLINE OR EDGE OF STREAM
- SILT FENCE
- HIGHLY VISIBLE FENCE
- SLOPE BREAK
- SEDIMENT BARRIER
- DIVERSION DITCH
- STRAW WATTLE
- DRAINAGE TRENCH AND PIPING
- ROCK CHECK DAM OR TOE BUTTRESS

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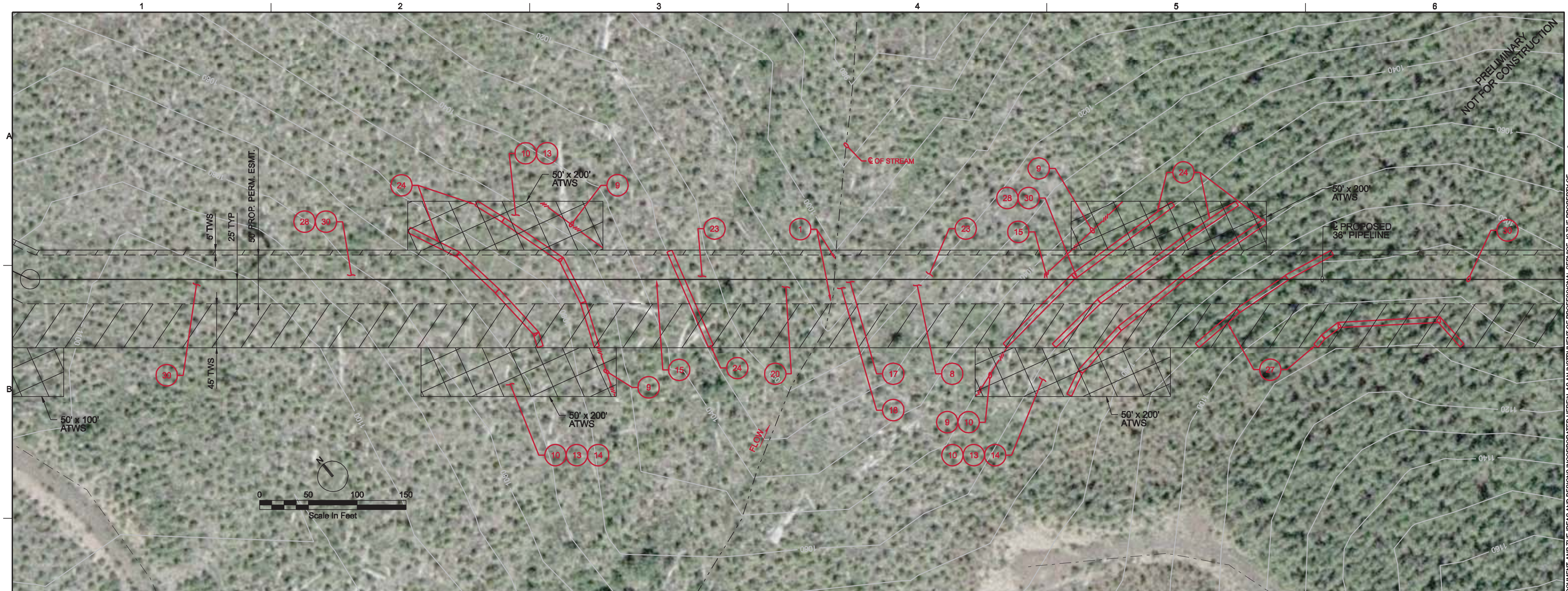
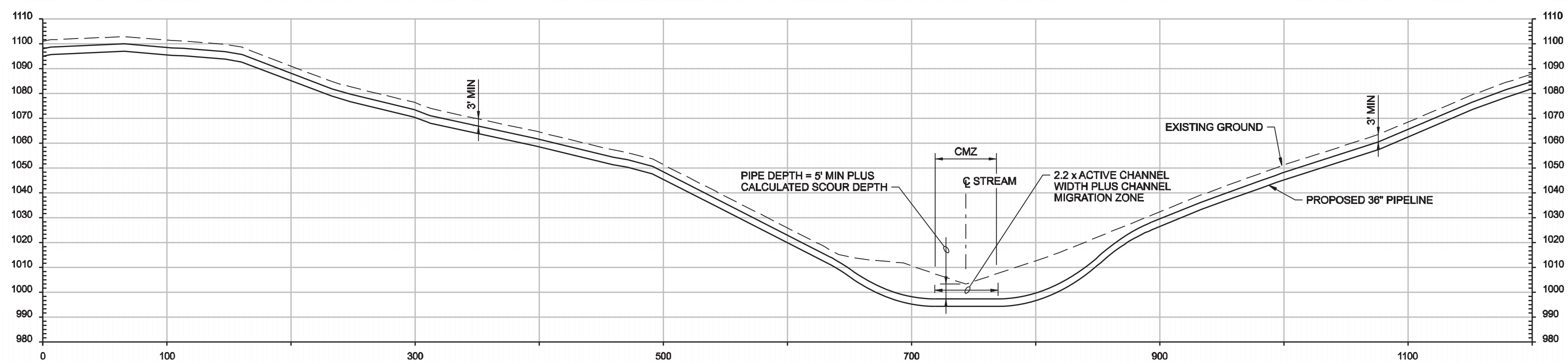
EROSION AND SEDIMENT CONTROL & LANDSLIDE AND DEBRIS FLOW KEYED NOTES

PROJ: 355036 | DATE: APRIL 27, 2009 | DWG: C-800 | REVISION: 1

FILENAME: C-800.dgn PLOT DATE: 9/14/2009 PLOT TIME: 11:32:04 AM





CMZ = ESTIMATED CHANNEL MIGRATION ZONE BASED ON PROFILE DRAWING

LEGEND

TWS (TEMPORARY WORK SPACE)
ATWS (ADDITIONAL TEMPORARY WORK SPACE)
WETLAND BOUNDARY
COUNTY LINE
PERMANENT EASEMENT LINE
ALIGNMENT PI (POINT OF INTERSECTION)
EDGE OF ROADWAY
ROADWAY CENTERLINE
CITY LIMIT LINE
PROPERTY LINE
FLOWLINE OR EDGE OF STREAM
SILT FENCE
HIGHLY VISIBLE FENCE
SLOPE BREAK
SEDIMENT BARRIER
DIVERSION DITCH
STRAW WATTLE
DRAINAGE TRENCH AND PIPING
ROCK CHECK DAM OR TOE BUTTRESS

SCALE 1"=50'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

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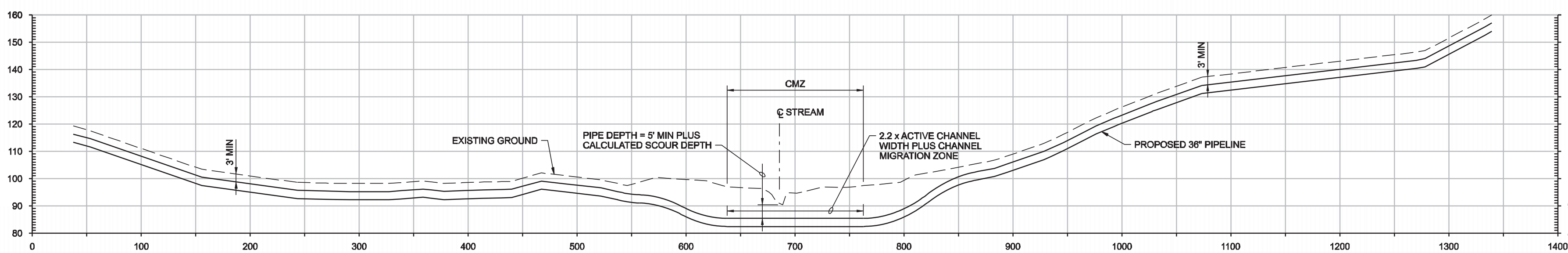
TYPICAL STREAM CROSSING
UNCONFINED,
2% TO 4% GRADIENT

PROJ: 355036	DATE: APRIL 27, 2009	DWG: C-801	REVISION: 1

FILENAME: C-801.dgn PLOT DATE: 9/11/2009 PLOT TIME: 12:40:44 PM



CMZ = ESTIMATED CHANNEL MIGRATION ZONE BASED ON PROFILE DRAWING

NO.	DATE	REVISION	BY	APVD

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SCALE
1"=50'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

LEGEND

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- STRAW WATTLE
- DRAINAGE TRENCH AND PIPING
- ROCK CHECK DAM OR TOE BUTTRESS

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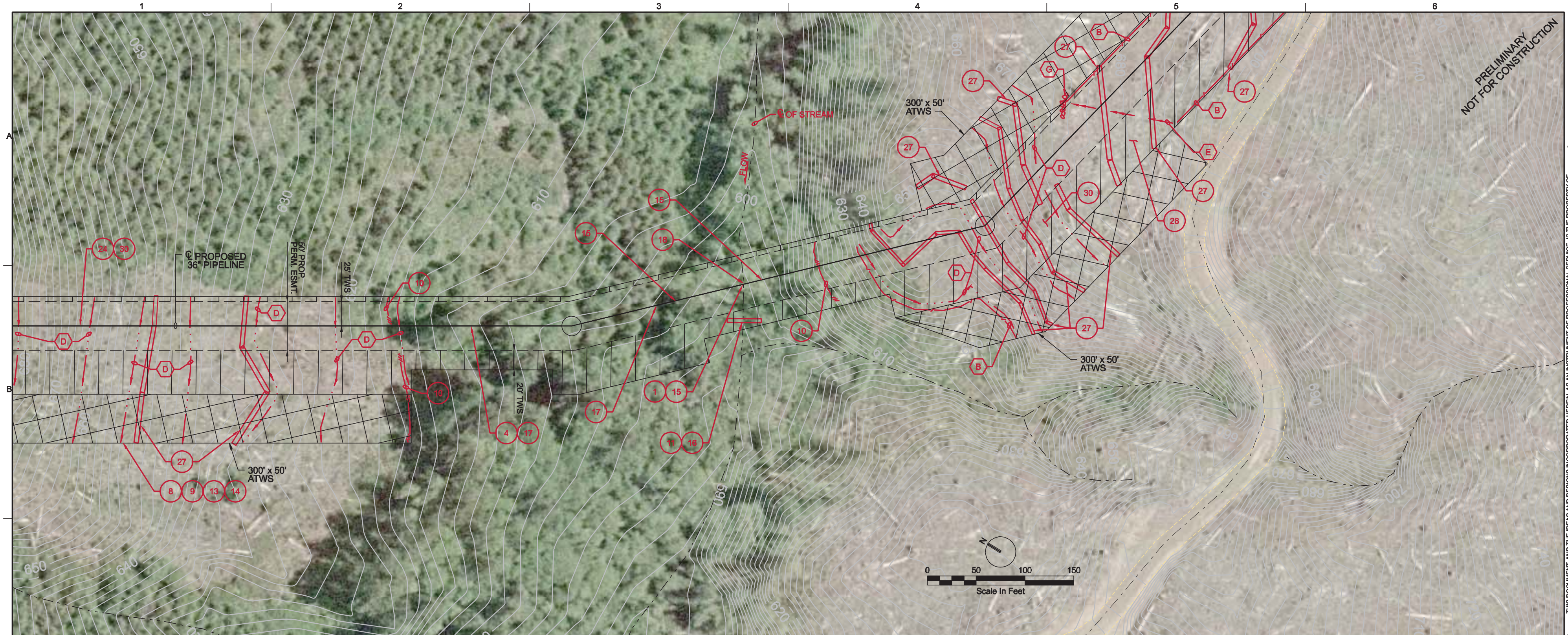
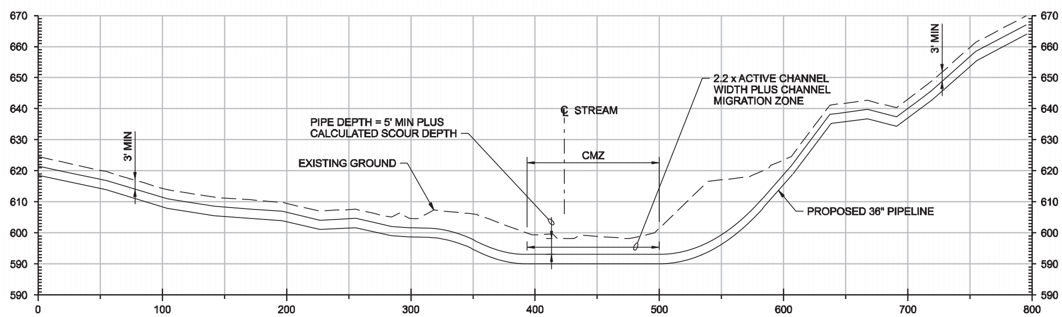
TYPICAL STREAM CROSSING UNCONFINED, 1% TO 2% GRADIENT

PROJ: 355036 | DATE: APRIL 27, 2009 | DWG: C-802 | REVISION: 1

FILENAME: C-802.dgn PLOT DATE: 9/11/2009 PLOT TIME: 12:41:01 PM





CMZ = ESTIMATED CHANNEL MIGRATION ZONE BASED ON PROFILE DRAWING

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SCALE

1"=50'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

LEGEND

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- SEDIMENT BARRIER
- DIVERSION DITCH
- STRAW WATTLE
- DRAINAGE TRENCH AND PIPING
- ROCK CHECK DAM OR TOE BUTTRESS

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TYPICAL STREAM CROSSING UNCONFINED, 4% TO 8% GRADIENT

PROJ:	355036	DATE:	APRIL 27, 2009	DWG:	C-803	REVISION:	1

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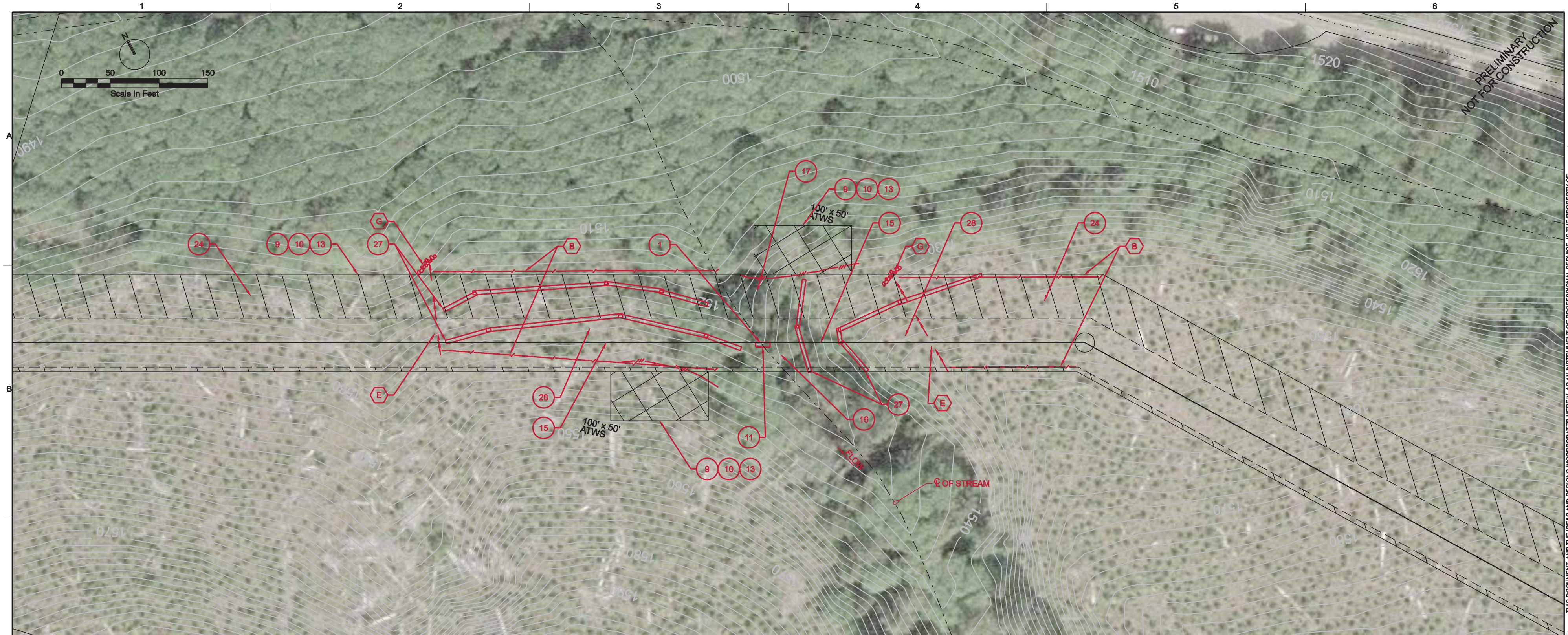
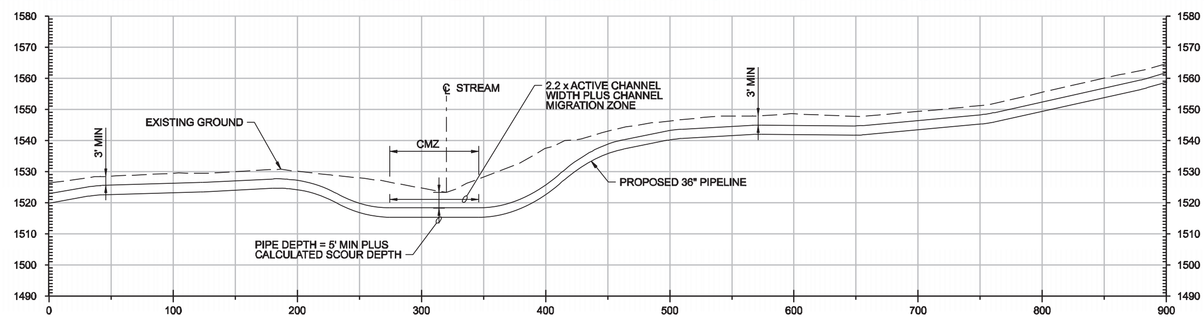




CMZ = ESTIMATED CHANNEL MIGRATION ZONE BASED ON PROFILE DRAWING

NO.	DATE	REVISION	BY	APVD

DSGN R SMETANA | DR J PFEIFER | CHK M BRICKER | APVD XXX

SCALE 1"=50'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

LEGEND

- TWS (TEMPORARY WORK SPACE)
- ATWS (ADDITIONAL TEMPORARY WORK SPACE)
- WETLAND BOUNDARY
- COUNTY LINE
- PERMANENT EASEMENT LINE
- ALIGNMENT PI (POINT OF INTERSECTION)
- EDGE OF ROADWAY
- ROADWAY CENTERLINE
- CITY LIMIT LINE
- PROPERTY LINE
- FLOWLINE OR EDGE OF STREAM
- SILT FENCE
- HIGHLY VISIBLE FENCE
- SLOPE BREAK
- SEDIMENT BARRIER
- DIVERSION DITCH
- STRAW WATTLE
- DRAINAGE TRENCH AND PIPING
- ROCK CHECK DAM OR TOE BUTTRESS

OregonLNG

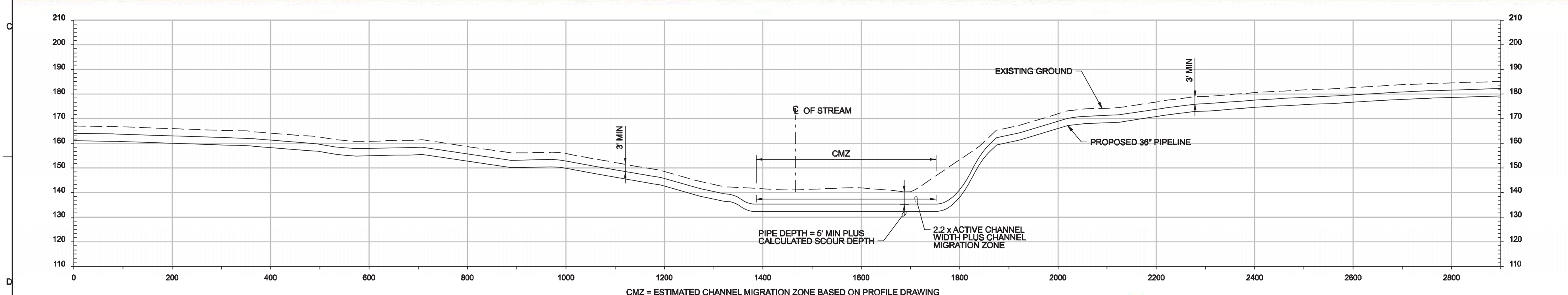
OREGON PIPELINE COMPANY
OREGON PIPELINE
WARRENTON TO MOLALLA

CH2MHILL

TYPICAL STREAM CROSSING
UNCONFINED,
8% TO 20% GRADIENT

PROJ: 355036 | DATE: APRIL 27, 2009 | DWG: C-804 | REVISION: 1

FILENAME: C-804.dgn PLOT DATE: 9/11/2009 PLOT TIME: 12:44:45 PM



CMZ = ESTIMATED CHANNEL MIGRATION ZONE BASED ON PROFILE DRAWING

NO.	DATE	REVISION	BY	APVD
DSGN R SMETANA	DR Y PFEIFER	CHK M BRICKER	APVD XXX	

SCALE

1"=100'

VERIFY SCALE

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LEGEND

- TWS (TEMPORARY WORK SPACE)
- ATWS (ADDITIONAL TEMPORARY WORK SPACE)
- WETLAND BOUNDARY
- COUNTY LINE
- PERMANENT EASEMENT LINE
- ALIGNMENT PI (POINT OF INTERSECTION)
- EDGE OF ROADWAY
- ROADWAY CENTERLINE
- CITY LIMIT LINE
- PROPERTY LINE
- FLOWLINE OR EDGE OF STREAM
- SILT FENCE
- HIGHLY VISIBLE FENCE
- SLOPE BREAK
- SEDIMENT BARRIER
- DIVERSION DITCH
- STRAW WATTLE
- DRAINAGE TRENCH AND PIPING
- ROCK CHECK DAM OR TOE BUTTRESS

OregonLNG

OREGON PIPELINE COMPANY

OREGON PIPELINE

WARRENTON TO MOLALLA

CH2MHILL

TYPICAL STREAM CROSSING
MODERATELY CONFINED,
1% TO 2% GRADIENT

PROJ:	355036	DATE:	APRIL 27, 2009	DWG:	C-805	REVISION:	1

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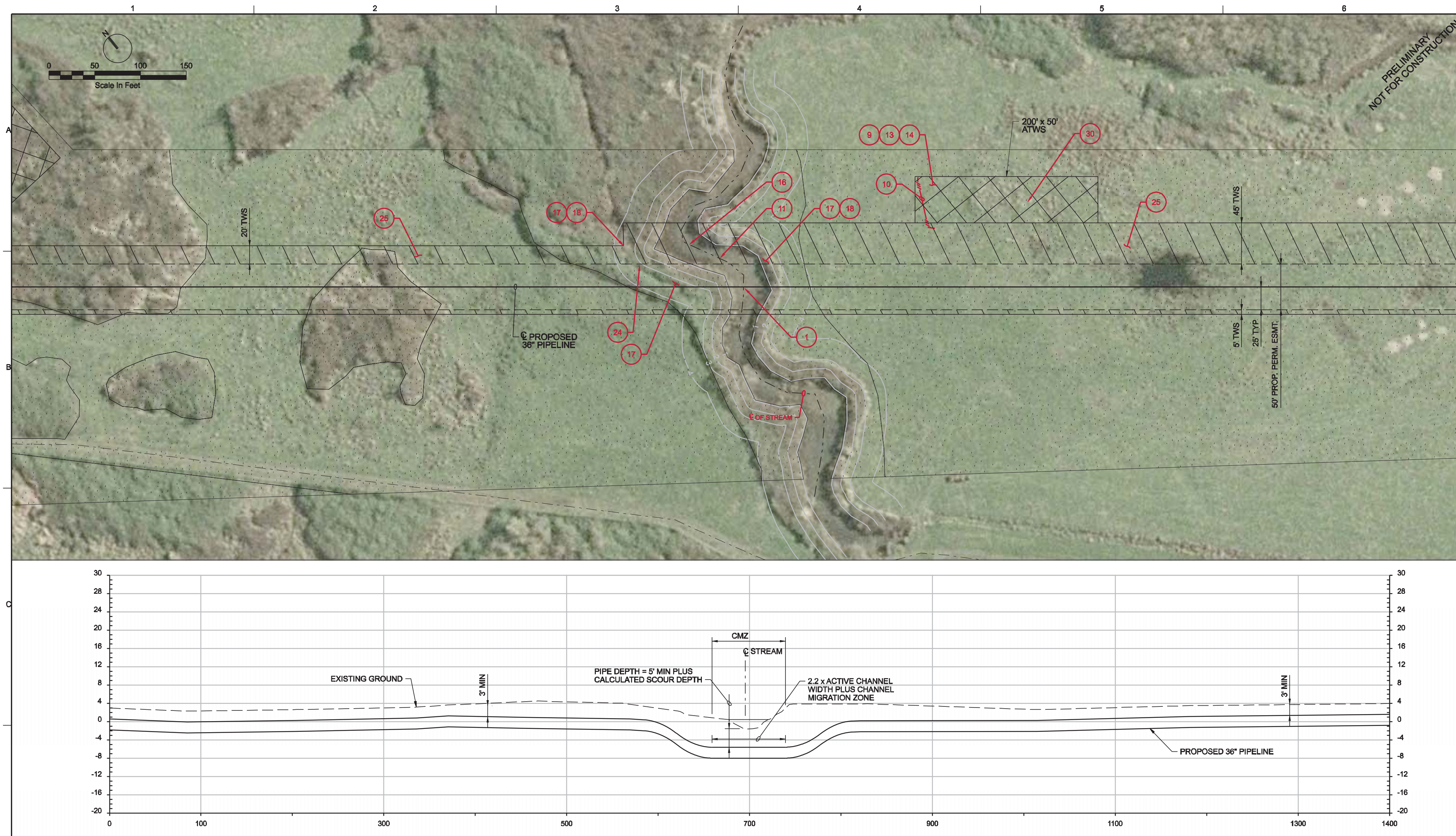

CMZ = ESTIMATED CHANNEL MIGRATION ZONE BASED ON PROFILE DRAWING

NO.	DATE	REVISION	BY	APVD

DSGN	DR	CHK	APVD
R SMETANA	J PFEIFER	M BRICKER	XXX

SCALE

1"=50'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.

0 1"

IF NOT ONE INCH THEN ADJUST SCALE ACCORDINGLY

LEGEND

- TWS (TEMPORARY WORK SPACE)
- ATWS (ADDITIONAL TEMPORARY WORK SPACE)
- WETLAND BOUNDARY
- COUNTY LINE
- PERMANENT EASEMENT LINE
- ALIGNMENT PI (POINT OF INTERSECTION)
- EDGE OF ROADWAY
- ROADWAY CENTERLINE
- CITY LIMIT LINE
- PROPERTY LINE
- FLOWLINE OR EDGE OF STREAM
- SILT FENCE
- HIGHLY VISIBLE FENCE
- SLOPE BREAK
- SEDIMENT BARRIER
- DIVERSION DITCH
- STRAW WATTLE
- DRAINAGE TRENCH AND PIPING
- ROCK CHECK DAM OR TOE BUTTRESS

OregonLNG

OREGON PIPELINE COMPANY

OREGON PIPELINE

WARRENTON TO MOLALLA

CH2MHILL

TYPICAL STREAM CROSSING
UNCONFINED,
1% OR LESS GRADIENT

PROJ:	355036	DATE:	APRIL 27, 2009	DWG:	C-806	REVISION:	1

FILENAME: C-806.dgn PLOT DATE: 9/11/2009 PLOT TIME: 12:45:05 PM

Appendix H
Migratory Bird Avoidance and Monitoring Plan for the Oregon LNG Project

Migratory Birds—Regulatory Review and Mitigation

PREPARED FOR: Resource Report 3

PREPARED BY Bridget Canty/PDX
Jay Lorenz/PDX
Renee Storey/PDX

DATE: May 1, 2013

Introduction

Migratory birds are protected by the federal Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 United States Code [U.S.C.] 703-712). The Memorandum of Understanding between the Federal Energy Regulatory Commission and U.S. Department of the Interior United States Fish and Wildlife Service (USFWS) regarding implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" (FERC and USFWS, 2011) (MBTA MOU) provides guidance on complying with the MBTA. This technical memorandum provides regulatory background on migratory birds relative to commercial logging and Pipeline operations. It also presents recommendations for avoidance of impacts to migratory birds and for stewardship compliance with the MBTA MOU. Oregon LNG proposes to clear land, including trees on commercial timberland, within a nominal 100-foot-wide construction corridor and associated additional temporary workspaces to accommodate the Pipeline. Vegetated habitats, including commercial forests, may provide habitat for many species of migratory birds, including raptors and songbirds.

Regulatory Background

Section 703 of the MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the U.S. Department of the Interior. The MBTA has no provision for allowing unauthorized take.

The MBTA MOU specifies that both parties shall support the conservation intent of Executive Order 13186, and the migratory bird conventions, to the extent possible and practicable, by the following:

- Integrating bird conservation principles, measures, and practices into agency actions;
- Avoiding or minimizing the take of migratory birds and adverse effects on their habitat;
- Improving habitat conditions for migratory birds on lands affected by energy projects; and
- Preventing or abating pollution detrimental to migratory birds and their habitats.

While the MBTA provides no mechanism for allowing unauthorized take, the USFWS recognizes that some birds may be taken during such activities as pipeline construction, even if all reasonable measures to avoid take are implemented. The USFWS Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the USFWS Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented (Rockies Express Pipeline LLC and USFWS, 2008).

A number of court cases have dealt with the authority of the MBTA and logging operations (Lurman, 2007).
In 2000, nine environmental groups, including the Center for Environmental Law, submitted a document (SEM-99-002) asserting that the Federal government was failing to enforce Section 703 of the MBTA. The

submitters claimed that logging operations consistently result in violations of the MBTA, killing an enormous number of birds, or destroying their nests and eggs. The submitters assert that, despite being aware of these violations, the United States never prosecutes logging operations that violate the MBTA. The submitters specifically referred to two cases in California where migratory birds were killed. The first case involves the logging of several hundred trees by a private landowner during the nesting season of great blue herons, allegedly resulting in hundreds of crushed eggs. The second case involves a logging company's alleged intentional burning of four trees on private land, including one allegedly used by a nesting pair of osprey.

In 2003, the North American Commission for Environmental Cooperation (CEC) conducted a legal review of how the MBTA has been applied to private logging operations (CEC, 2003). The CEC determined that there has never been a prosecution of a private timber harvest operation since the MBTA was enacted in 1918. The CEC concluded the following:

- USFWS has long had an "unwritten policy relative to the MBTA that no enforcement or investigative action should be taken in incidents involving logging operations, that result in the taking of non-endangered, non-threatened migratory birds and/or their nests"
- Because of limited resources, USFWS has "concentrated its regulatory, enforcement, and scientific efforts to reducing unintentional takes of migratory birds caused by those activities where industry has created hazardous conditions which often attract migratory birds to their death (i.e., birds attracted to perching on power lines or open oil pits that appear as water ponds to overflying birds"
- "Alternative statutes and non-enforcement initiatives are more effective and efficient in protecting migratory birds [and] habitat modification *per se* is not prohibited by the MBTA. This means that establishing a violation of the MBTA due to logging activities poses more significant technical challenges than many other types of MBTA violations. Therefore, the USFWS has thus far made *bona fide* decisions to allocate enforcement resources to investigating and prosecuting other possible violations instead of those caused by logging activities. The USFWS made its resource allocation decisions in good faith and always with the objective to conserve migratory bird populations and their habitats in sufficient quantities to prevent them from becoming threatened or endangered." (CEC, 2003)

On advice of counsel, it does not appear that the MBTA imposes an affirmative duty to take specific action under the MBTA, other than to avoid taking of migratory birds. Logging associated with clearing a Pipeline corridor by itself does not trigger the need for a permit or other regulatory approval under the MBTA, as habitat destruction alone does not constitute a "take" under the MBTA (*Seattle Audubon Society v. Evans,* 952 F.2d 297 [9th Cir., 1991]; *City of Sausalito v. O'Neill*, 386 F.3d 1186 [9th Cir., 2004]). However, in the interest of being good stewards of the environment that the Pipeline will affect, it is recommended that measures be taken to avoid take.

Mitigation

Oregon LNG will take reasonable and prudent measures to avoid the taking of birds protected by the MBTA and in accordance with the MBTA MOU. These measures are in addition to those that may be imposed to protect birds protected under the Endangered Species Act, such as the northern spotted owl and marbled murrelet (see Resource Report 3, Appendix 3E).

Land clearing will take place the same year as Pipeline construction (see Resource Report 1 for a Project schedule). Clearing will take place as late as possible in the spring and early summer to avoid as much of the nesting season as possible. Oregon LNG proposed land clearing in the late summer and early fall prior to Pipeline construction. The National Marine Fisheries Service (NMFS) was concerned that such a schedule increased risk of erosion into streams, particularly salmon-bearing streams. The USFWS, in consultation with NMFS, advised Oregon LNG that the preferred schedule would be to conduct land clearing the same year as construction. The corridor would then be rehabilitated at the end of the construction season, thereby limiting and minimizing exposure and risk of soil erosion.

Assuming that vegetation clearing cannot be avoided during the entire nesting and breeding season, Oregon LNG will provide biologists to conduct a preconstruction reconnaissance of the Terminal and Pipeline corridor to identify any active migratory bird nests. If one or more active nests are identified within the construction corridor, biologists will mark the location(s) of the nest(s) in the field and on the construction plans and delay vegetation clearing around the active nest(s) until such time as the nest(s) have fledged or failed (due to natural causes). If one or more active nests are identified outside the construction corridor but nearby, the biologists will monitor the nest(s) during construction for signs of disturbance. If it appears that the monitored nest(s) are exhibiting disturbance that could lead to unintentional indirect take pursuant to the MBTA, construction should be halted temporarily until such time as the nest has fledged or failed (due to natural causes). Trees with nests may be cut during the non-nesting season. Preconstruction surveys will include an aerial survey for raptor nests in late March prior to trees leafing out.

Vegetation clearing shall not occur within 500 feet of any existing eagle, osprey, or other raptor nest locations or trees used by such birds unless a variance is granted, in writing, by USFWS. Band-tailed pigeon nesting or roosting tree(s), as well as any tree(s) near an existing great blue heron rookery, are not to be removed unless the USFWS approves it in writing. Removing trees in a designated nest patch of a northern spotted owl shall be avoided. Removing trees in a cluster of trees known to provide nesting for marbled murrelets shall be avoided.

Unintentional take, the observation that land clearing has unintentionally killed a migratory bird, shall be reported to Oregon LNG's designated environmental compliance officer within 24 hours of such an incident. The environmental compliance officer will be responsible for reporting the unintentional take to USFWS.

Oregon LNG will rehabilitate the Pipeline corridor to provide habitat for birds and other wildlife. In addition, Oregon LNG proposed extensive upland and riparian habitat mitigation in the *Applicant-Prepared Conceptual Mitigation Plan for the Oregon LNG Terminal and Oregon Pipeline Project* (CH2M HILL, 2009). The habitat mitigation proposed in the conceptual mitigation plan places an emphasis on preservation and management toward late-successional forests and riparian habitats that are in decline in the Coast Range. The combination of rehabilitation of the Pipeline corridor, long-term conservation of upland, and riparian habitats will benefit migratory birds.

References

CH2M HILL. 2009. *Applicant-Prepared Conceptual Mitigation Plan for the Oregon LNG Terminal and Oregon Pipeline Project.* FERC Dockets Docket Nos. CP09-6-000 and CP09-7-000.

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Lurman, J. 2007. "Agencies in Limbo: Migratory Birds and Incidental Take by Federal Agencies." *Journal of Land Use* 23(1): 39-60.

North American Commission for Environmental Cooperation (CEC). 2003. *Final Factual Record for Submission SEM-99-002 (Migratory Birds)*. North American Environmental Law and Policy, Volume 11.

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APPENDIX F4

WETLAND MITIGATION PLAN

Wetland Mitigation Plan

Chapter 1—Introduction

1.1 Purpose and Organization of Wetland Mitigation Plan

The purpose of the wetland mitigation plan is to present additional information on wetlands that are located within the construction and permanent easements (also referred to as temporary workspace and permanent easement) for the Oregon LNG Pipeline, Terminal, and related aboveground facilities (collectively referred to as the Project). The wetlands under discussion are identified in the wetland delineation reports in Appendix 2E of Resource Report 2—Water Use and Quality. The wetland information provided in this mitigation plan includes a summary of wetland impacts by hydrogeomorphic (HGM) and Cowardin class by subbasin (the 4th-field hydrologic unit code [HUC] unit); and the approach to mitigating wetland impacts associated with the Project.

Chapter 2—Impact Assessment

2.1 Methodology

2.1.1 Terminal

Impacts to wetlands associated with the Terminal and related facilities were quantified as temporary if they were within the area disturbed by construction but outside the permanent facility and removal/fill footprint. The impacts were quantified as permanent if they were within the permanent facility or removal/fill footprint. Figure 1 of Resource Report 2—Water Use and Quality, as updated in the April 3, 2014, Terminal Supplement filed with FERC (LNG Development Corporation, LLC [d/b/a Oregon LNG] and CH2M HILL, 2014), shows the Terminal footprint and affected wetlands.

2.1.2 Pipeline

Impacts to wetlands associated with the Pipeline construction and operation were quantified based on the proposed activity in temporary construction and permanent operation zones. Planned construction and operation activities in wetlands are described in Section 2.3.3 and Table 5 of Resource Report 2; Appendix 1 of Resource Report 1—General Project Description; and in Appendix 2B of Resource Report 2. Figure 1 illustrates the construction and operation effects to wetlands by Cowardin class. Table 1 provides a summary of how wetland impacts associated with temporary and permanent easements and planned maintenance activities were determined.

TABLE 1
Determination of Wetland Impacts Associated with Permanent and Temporary Easements and Planned Maintenance Activities

	75-foot Wetland Crossing Width			
	50-foot-wide Permanent Easement			25-foot-wide Construction Easement
	A	B	C	D
Easement	10-foot-wide mow strip centered over Pipeline	Additional 20-foot-wide area (10 feet on each side of the mow strip)	20-foot-wide area on outside boundary of easement (outer 10 feet of 50-foot-wide permanent easement)	25-foot-wide additional area needed for construction; 5 feet on one side and 20 feet on the other side of the 50-foot-wide permanent easement
Frequency of Maintenance Activities	Annual mowing	Every 3 years, routine maintenance to cut trees over 15 feet tall	No maintenance activity	No maintenance activity
Wetland Type	**Type of Wetland Impact**	**Type of Wetland Impact**	**Type of Wetland Impact**	**Type of Wetland Impact**
PEM	Temporary during construction	Temporary during construction	Temporary during construction	Temporary during construction
PSS	Temporary wetland impacts during construction; permanent conversion of wetland type to PEM	Temporary	Temporary	Temporary
PFO	Temporary wetland impact during construction; permanent conversion of wetland type to PEM	Temporary wetland impact during construction; permanent conversion of wetland type to PEM or PSS	Temporary impact during construction	Temporary impact during construction

PEM = Palustrine Emergent Wetland
PFO = Palustrine Forested Wetland
PSS = Palustrine Scrub-shrub

When constructing the Pipeline through nonagricultural wetlands, soil excavation will occur at the Pipeline trench area, which will be about 10 feet wide, depending on the depth of the pipe. Temporary fill will occur next to the trench, where soil and plant materials from the trench will be stockpiled. Indirect soil disturbance, resulting in removal/fill, is expected to occur throughout the 75-foot-wide construction corridor from aboveground vegetation removal and mechanized land clearing, which could result in soil displacement. Following construction, wetlands will be rehabilitated to preconstruction soil and hydrology conditions, and revegetated. Operational vegetation maintenance activities will preclude forested wetlands in the 30-foot-wide maintenance corridor and the scrub-shrub wetlands from the 10-foot-wide corridor centered over the pipe.

As a result of the operation activities, the following assessment of Project operational impacts can be made for the 50-foot-wide permanent easement:

- Impacts to emergent wetlands within the 50-foot-wide permanent easement will be temporary.
- Impacts to scrub-shrub wetlands within the 50-foot-wide permanent easement will be temporary, with the exception of the 10-foot-wide mow strip over the Pipeline. Scrub-shrub wetlands within the 10-foot-wide mow strip will retain their wetland hydrology and hydric soil, but the dominant vegetation will shift to mostly herbaceous and trailing woody groundcover. Scrub-shrub wetlands outside the 10-foot-wide mow strip but within the 30-foot-wide maintenance easement will be restored to scrub-shrub vegetation. However, shrubs within the 30-foot-wide maintenance easement exceeding 15 feet in

height may be cut for Pipeline safety. Therefore, for purposes of determining impacts requiring compensatory mitigation, impacts to scrub-shrub wetlands within the 30-foot-wide maintenance easement will be considered permanent impacts requiring compensatory mitigation.

- Impacts to forested wetlands within the 50-foot-wide permanent easement will be temporary with the exception of a 30-foot-wide maintenance corridor over the Pipeline. Preconstruction forested wetlands will retain their wetland hydrology and hydric soil, but the dominant vegetation will shift to mostly herbaceous and trailing woody groundcover within the 10-foot-wide mow strip and to scrub-shrub wetlands elsewhere in the 30-foot-wide maintenance corridor where trees exceeding 15 feet in height may be cut for Pipeline safety. However, because of the temporal lag in restoring forested wetlands, for purposes of determining impacts requiring compensatory mitigation, impacts to forested wetlands within the 50-foot-wide permanent easement will be considered permanent impacts requiring compensatory mitigation.

The following assessment of Project construction impacts can be made for the portions of the 75-foot-wide construction corridor outside the 50-foot-wide permanent easement:

- Impacts to emergent wetlands within the 75-foot-wide construction easement outside of the 50-foot-wide permanent easement will be temporary.
- Impacts to scrub-shrub wetlands within the 75-foot-wide construction easement outside of the 50-foot-wide permanent easement will be temporary.
- Impacts to forested wetlands within the 75-foot-wide construction easement outside of the 50-foot-wide permanent easement will be temporary. However, because of the temporal lag in restoring forested wetlands, for purposes of determining impacts requiring compensatory mitigation, impacts to forested wetlands within the 75-foot-wide construction easement will be considered permanent impacts requiring compensatory mitigation.

2.2 Results

For the Terminal and associated facilities, wetland impacts are categorized as temporary (as a result of construction-related activities) or permanent (as a result of removal/fill associated with construction of the Terminal and associated facilities). Table 2 shows the wetland impacts associated with the Terminal and associated facilities by watershed subbasin (4th-field HUC) and by HGM and Cowardin wetland class.

For the Pipeline mainline and associated aboveground facilities, the Project's impacts to wetlands were determined using the method described in Section 2.1.2. Impacts were categorized as temporary wetland impacts or permanent Cowardin class changes. Temporary wetland impacts include impacts to wetlands within the 75-foot-wide construction corridor as a result of construction and operation of the Project. Permanent Cowardin class changes include impacts to forested or scrub-shrub wetlands within the 10-foot-wide and 30-foot-wide prescribed maintenance zones shown on Figure 1.

Table 3 presents a summary of temporary impacts for the Pipeline and ancillary facilities by watershed subbasin (4th-field HUC) and by HGM and Cowardin wetland class. Table 4 presents a summary of permanent Cowardin class changes for the Pipeline and ancillary facilities by watershed subbasin (4th-field HUC) and by HGM and Cowardin wetland class.

TABLE 2

Terminal and Ancillary Facilities —Temporary and Permanent Wetland Impacts (acres)

4th-field HUC	HGM	Impact Type	E2EM	PEM	PSS	PFO	Grand Total
Lower Columbia	Estuarine Fringe	Permanent	28.04	0.01			**28.05**
		Temporary	1.31	0.01			**1.32**
	Estuarine Fringe Total		**29.35**	**0.02**	**0.00**	**0.00**	**29.37**
	Depressional	Permanent	0.03	1.42	4.21	0.16	**5.82**
		Temporary	0.00	1.42	0.15	0.00	**1.57**
	Depressional Total		**0.03**	**2.84**	**4.36**	**0.16**	**7.39**
	TBD	Permanent				1.05	**1.05**
		Temporary		0.25	0.01		**0.27**
	TBD Total		**0.00**	**0.25**	**0.01**	**1.05**	**1.31**
Terminal Total			**29.38**	**3.12**	**4.37**	**1.21**	**38.08**

Note: Includes Terminal access road and water/wastewater pipelines.

E2EM = Estuarine Intertidal Emergent
HGM = hydrogeomorphic
HUC = hydrologic unit code
PEM = Palustrine Emergent Wetland
PFO = Palustrine Forested Wetland
PSS = Palustrine Scrub-shrub
TBD = to be determined. Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined. Before construction, these wetland areas will be delineated and the HGM class will be determined.

TABLE 3

Pipeline and Ancillary Facilities—Temporary Wetland Impacts (acres)

4th-field HUC	HGM	AW	E2USN	PEM	PSS	Grand Total
Lower Columbia	Depressional	1.61		5.92	1.85	**9.38**
	Estuarine Fringe		5.06			**5.06**
	Flats			0.81	0.07	**0.87**
	Riverine			0.79		**0.79**
	Slope			0.60	0.32	**0.91**
	TBD	30.20		11.03	3.40	**44.63**
Lower Columbia Total		**31.81**	**5.06**	**19.14**	**5.64**	**61.65**
Nehalem	Depressional			1.25	0.46	**1.71**
	Flats			0.04		**0.04**
	Riverine			1.02	0.01	**1.04**
	Slope			2.17		**2.17**
	TBD	2.73		0.16	0.25	**3.14**
Nehalem Total		**2.73**		**4.65**	**0.72**	**8.09**
Lower Willamette	Depressional				0.12	**0.12**
Lower Willamette Total					**0.12**	**0.12**
Lower Columbia-Clatskanie	Depressional			0.02		**0.02**
	Riverine			0.02	0.16	**0.18**
	Slope			0.33	0.68	**1.01**
	TBD			13.13		**13.13**
Lower Columbia-Clatskanie Total				**13.50**	**0.84**	**14.33**

TABLE 3
Pipeline and Ancillary Facilities—Temporary Wetland Impacts (acres)

4th-field HUC	HGM	AW	E2USN	PEM	PSS	Grand Total
Lewis	TBD			0.18		**0.18**
Lewis Total				**0.18**		**0.18**
Pipeline Total		**34.54**	**5.06**	**37.47**	**7.30**	**84.37**

Note: Includes compressor stations, pipe yards, and access roads.

AW = Agricultural Wetland
E2USN = Estuarine Intertidal Unknown Temporary Tidal Regular
HGM = hydrogeomorphic
HUC = hydrologic unit code
PEM = Palustrine Emergent Wetland
PSS = Palustrine Scrub-shrub
TBD = to be determined. Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined. Before construction, these wetland areas will be delineated and the HGM class will be determined.

TABLE 4
Pipeline and Ancillary Facilities—Permanent Wetland Impacts (acres)

4th-field HUC	HGM	PFO	PSS	PSS/PFO	Grand Total
Lower Columbia	Depressional		1.00		**1.00**
	Flats	0.34	0.04		**0.38**
	Riverine	0.66			**0.66**
	Slope	0.49	0.24		**0.73**
	TBD	2.79	1.35		**4.14**
Lower Columbia Total		**4.28**	**2.63**		**6.91**
Nehalem	Depressional	0.29	0.37		**0.66**
	Riverine	0.91			**0.91**
	Slope	1.45			**1.45**
	TBD	0.20	0.18	6.41	**6.79**
Nehalem Total		**2.85**	**0.55**	**6.41**	**9.82**
Lower Willamette	Depressional	0.34	0.07		**0.42**
	Riverine	0.89			**0.89**
Lower Willamette Total		**1.24**	**0.07**		**1.31**
Lower Columbia-Clatskanie	Riverine	0.98	0.16		**1.14**
	Slope	0.33	0.23		**0.55**
	TBD	2.96			**2.96**
Lower Columbia-Clatskanie Total		**4.27**	**0.39**		**4.66**
Pipeline Total		**12.64**	**3.64**	**6.41**	**22.70**

Note: No impacts to wetlands in pipe yards.

Cowardin = Cowardin et al., 1979
HGM = hydrogeomorphic
HUC = hydrologic unit code
PFO = Palustrine Forested Wetland
PSS = Palustrine Scrub-shrub
TBD = to be determined. Proxy wetland data were used for sites where access was not provided. Hydrogeomorphic class could not be determined. Before construction, these wetland areas will be delineated and the HGM class will be determined.

Chapter 3—Mitigation

3.1 Introduction

This chapter lays out the approach to wetland mitigation based on the determination of impacts in Chapter 2. The approach to mitigation follows the U.S. Army Corps of Engineers (USACE) and Oregon Department of State Lands (DSL) rules and guidance with the goal of no net loss of wetland functions and values. The approach follows the USACE and DSL mitigation sequencing and, where compensation is required, uses a watershed approach to select available resource replacement sites that offer the greatest functional benefits.

3.2 Avoidance

The wetland delineation report submitted to DSL (Appendix 2E) shows the wetlands identified in the Project study area. The Project will avoid most wetlands in the study area. Temporary and permanent impacts for the Terminal and Pipeline total approximately 145 acres of wetlands identified in the study area, which covers more than 2,700 acres. During several design iterations, the Pipeline alignment and temporary workspaces were shifted away from wetlands and other waters, where possible, reducing the acreage of impact. In addition, during construction, wetlands outside of the construction corridor will be demarcated in the field and identified on work plans as "no work zones" to avoid additional wetland impacts.

Site visits were conducted with state and federal agency staff to view stream crossings identified as areas of concern during preliminary agency reviews. Micrositing adjustments were made to avoid or minimize impacts to wetlands or streams. For example, in a location where the pipeline was proposed to cross a beaver marsh on the Clatskanie River, the route was relocated to avoid the wetland and limit impacts to a narrow stream crossing.

Large wetland areas will be avoided using the horizontal directional drill (HDD) construction method. More than 24 acres of wetlands associated with the Adairs Slough and the Lewis and Clark River area will be avoided using the HDD drilling method. Further avoidance efforts are demonstrated with the type of access road the Project proposes to use. Access to the temporary and permanent Pipeline easement and aboveground facilities will be through existing public and private roads to the extent practical. Where the Pipeline parallels existing utilities, Oregon LNG will use the utility maintenance access roads to the extent practical. Oregon LNG will also use a combination of existing paved, existing gravel, modified gravel, pasture roads, and other conveyances as appropriate.

Construction measures will be implemented to avoid impacts to wetlands along the Pipeline route. The width of the construction corridor will be narrowed from 100 to 75 feet across nonagricultural wetlands. HDDs beneath streams and adjacent wetlands will also avoid impacts to wetlands and waterbodies.

3.3 Minimization

Efforts will be made before, during, and after Pipeline construction to minimize the extent and duration of Project-related disturbances to wetland resources. For example, Oregon LNG will segregate and salvage the top 1 foot of topsoil from nonsaturated wetland areas to be disturbed by trenching (generally coincident with the 10-foot-wide mow strip maintained during operation) and replace the topsoil at the finish grade after trench reconstruction. The duration of temporary wetland disturbance during Pipeline construction will be minimized. The backfilled trench will contain anti-seep plugs at appropriate intervals to prevent a French drain effect. A detailed description of other measures to minimize construction and post-construction maintenance effects on wetlands is provided in Appendix 2B, *FERC Wetland and Waterbody Construction and Mitigation Procedures, Modified by Oregon LNG*, Section VI.

Temporal disturbance to streams will be minimized by limiting in-water work at crossings to 48 hours or less and application of best management practices (see Appendix 2H, *Stormwater Pollution Prevention Plan for*

Construction of the Oregon LNG Pipeline, Including Erosion Prevention and Sediment Control Plan; Spill Prevention, Control, and Countermeasures Plan; and Frac-out Contingency Plan).

Techniques for modifying the Pipeline alignment to minimize wetland impacts include the following:

- HDD methods will be used to install the Pipeline many feet below the surface of wetlands and streams.
- The Pipeline will be aligned parallel or with existing road right-of-way (ROW) utility corridors, or previously disturbed areas.
- The Pipeline will be aligned so that wetlands are crossed at their narrowest point, when possible.
- The Pipeline will be aligned so that streams are crossed at a right angle to their banks to minimize negative impacts to riparian areas and streambeds.
- The width of the Pipeline ROW will be reduced to 75 feet when crossing nonagricultural wetlands to minimize the area of disturbance.
- TWS will be located in areas outside of wetlands to minimize the number of acres of disturbance.

In selecting the proposed route, Oregon LNG sought to minimize impacts to the environment and landowners by paralleling other linear features to the greatest extent possible or practical. Minimizing impacts to wetlands did have limitations due to rugged topography, high densities of wetland areas, and a preference to avoid high-quality wetland areas and streams. In areas where a high density of wetlands existed, the Pipeline was aligned in a way that minimized impacts to most wetlands. The Pipeline route was sometimes aligned to cross wetlands with low functional assessment values to avoid wetlands with higher values. If the Pipeline could be microsited to avoid every wetland, the overall length of the Pipeline and period of active construction would increase, which could result in more permanent impacts to the landscape and longer periods of temporary disturbance and active construction along the Pipeline route.

3.4 Compensation

For the Project, the approach to compensatory mitigation follows the USACE and U.S. Environmental Protection Agency (EPA) Wetland Compensatory Mitigation Rule (March 2008) and DSL guidance emphasizing a watershed-level approach to compensation. Previous EPA and USACE guidance favored mitigation in proximity of impacts, but the Wetland Compensatory Mitigation Rule lists this hierarchy of mitigation preferences: (1) mitigation banks, (2) in-lieu fee programs, and (3) permittee-responsible mitigation (in the event neither of the previous two options is practicable). Compensatory mitigation should be directed to restoring impaired functions in a watershed context.

Oregon LNG proposes a three-pronged approach to compensatory mitigation for Pipeline impacts consisting of: (1) rehabilitation of wetlands temporarily impacted by construction in situ, (2) purchase of mitigation credits from wetland mitigation banks (if available) or in-lieu fee programs, and (3) replacement of lost wetland functions through wetland restoration, creation, or enhancement. These three compensatory mitigation approaches are described in more detail subsequently. Under each of the approaches described below, in-kind replacement of affected wetlands (that is, Palustrine Emergent [PEM], Palustrine Scrub-shrub [PSS], and Palustrine Forested Wetland [PFO]) will be proposed where feasible). Out-of-kind compensatory mitigation may be justified where there have been significant losses of a particular Cowardin (Cowardin et al., 1979) classification or function within a watershed (for example, loss of estuarine floodplain as a result of diking or loss of marsh habitat along streams as a result of depleted populations of beavers). Depending on the functions being replaced, out-of-kind mitigation may be a viable compensatory mitigation strategy, especially when, for a given watershed, there are important goals for recovery of other aquatic functions or habitat for important species.

Final plans will be provided to the Federal Energy Regulatory Commission (FERC) following final filing.

3.4.1 Terminal

Offsite Compensatory Wetland Mitigation for Temporary and Permanent Impacts. For the Terminal, 3.16 acres of temporary and approximately 34.92 acres of permanent impacts will occur as a result of Terminal and ancillary facilities construction.

Between 1870 and 1983, the area of tidal swamps and marshes in the Columbia River estuary was reduced by 35 percent. Within Youngs Bay, by 1983, tidal swamps and marshes were reduced to about 11 percent of their former area in 1879 (Thomas, 1983). The reduction of swamp and marsh habitat around Youngs Bay was primarily the result of diking.

Oregon LNG secured 120 acres at the mouth of the Youngs River on the west bank for Terminal wetland mitigation (Figure 2). The mitigation site is a portion of the historical tidal swamp and marsh that was lost to diking. The riverside parcel is currently used for grazing and protected from flooding by a levee. Oregon LNG intends to breach the levee to create estuarine wetland habitat and provide access for federally listed salmonids and other aquatic species. Salmonid and other fish habitat at this strategic site at the mouth of the Youngs River will be enhanced by restoring meandering historical channels within the property. To ensure that juvenile salmonids can utilize newly created marsh habitat during low tide conditions, Oregon LNG will create breaches in areas that facilitate connection to existing subtidal habitat in Youngs Bay. Hydrodynamic modeling conducted by Coast and Harbor Engineering (2011) showed that breaching the dike in two or three locations will reconnect the historical floodplain with the tidal estuary, providing in-kind mitigation for wetland impacts at the Terminal. To protect inland residents, the existing dike will be modified to encompass the 120-acre mitigation site. Hydrodynamic modeling suggests that after resumption of more natural tidal regimes, the property will establish as low marsh. After native freshwater marsh plants have recolonized the property, the marsh is expected to provide productive new rearing habitat for juvenile salmon that use Youngs Bay, and possibly for green sturgeon prey.

The area is large enough to provide mitigation for wetland impacts at the Terminal at a 3:1 ratio (in accordance with Oregon Administrative Rule 141-085-0690[4][C]) and for other wetland impacts in the Lower Columbia 4th-field HUC.

A legal instrument is in place for Oregon LNG to use the property at the mouth of the Youngs River on the west bank for mitigation, including an agreement for a long-term conservation easement as a condition of a deed. Provisions are in place for supporting long-term maintenance and management, including a revolving or endowment fund. Oregon LNG will prepare a long-term management plan to be implemented by a third-party conservator.

Mitigation Goals and Objectives. Mitigation goals include the following:

- Reconnect 120 acres of historical floodplain with the Columbia River estuary.
- Create a low-maintenance and self-sustaining system.
- Assure that the safety of landowners behind the dike is maintained.

Mitigation objectives include the following:

- Restore a minimum of 2,600 feet (approximately 0.5 mile) of side-channels or sloughs.
- Achieve 100 percent inundation during high tides.
- Restore emergent and forest habitat dominated by a diversity of native plants

Temporary impact areas will be rehabilitated onsite after construction. Rehabilitation initially involves seedbed preparation and control of noxious weeds. Some vegetation will regenerate naturally from the seedbank and vegetative propagules. Supplemental propagules of water parsley (*Oenanthe sarmentosa*), Pacific silverweed (*Argentina egedii*), and Lyngby's sedge (*Carex lyngbyei*) will be planted in the late winter, as needed, to rehabilitate temporary impacts to wetlands at the Terminal. If shoreline monitoring determines that potentially damaging erosion is occurring, and that stabilization measures will reduce erosion potential, appropriate measures pursuant to federal and state permits will be implemented. Soft armoring techniques will be emphasized, such as vegetation and brush layering.

3.4.2 Pipeline

Temporary Impacts. Compensation for temporary impacts to wetlands as a result of Pipeline construction will be mitigated through onsite wetland rehabilitation. To the extent feasible, rehabilitation of the Pipeline construction corridors to preconstruction wetland conditions will be undertaken. This will involve topsoil segregation and replacement, topsoil management to maintain viability of seedbank and vegetative propagules, reconstruction of grades, permanent erosion control seeding with native wetland species, and seedbed preparation where soils are displaced or compacted by equipment. This mitigation measure is appropriate for approximately 84.37 acres of temporary Pipeline impacts shown in Table 3. Figures 3 through 8 show typical wetland restoration for Palustrine Emergent, Palustrine Scrub-shrub, and Palustrine Forest/Palustrine Emergent wetlands within the Lower Columbia Watershed and the Nehalem Watershed.

The wetland areas temporarily impacted by vegetation clearing, equipment traffic, and material storage outside the trench area will be rehabilitated by reestablishing wetland vegetation from seedbank germination and vegetative propagation via resprouting of live roots and propagules left intact and protected during construction. Sterile wheat grass cover will be used to temporarily stabilize soil until natural germination occurs. In some instances, a permanent native wetland seed mix will be applied to ensure adequate cover of the site by desirable species. If annual monitoring during the 3 years after construction indicates that disturbed areas are not successfully revegetating with wetland herbaceous or woody plants similar to preconstruction conditions, supplemental seeding or planting will be undertaken. Woody species will resemble local reference conditions. Measures will be taken to control the spread of noxious weeds.

For natural regeneration of temporarily cleared forested wetlands outside the 30-foot-wide maintenance corridor, the following actions will be taken:

- To reduce injury to viable roots and shoots, construction traffic will be managed to reduce areas affected by soil compaction and rutting; supported by mats, pallets, or other ground pressure dissipaters in moist or wet soils; and characterized by low-ground pressure equipment where terrain allows.
- Woody debris, chipped woody vegetation, and unmerchantable logs greater than 12 inches in diameter will be salvaged for surface application outside the 30-foot-wide maintenance corridor where existing downed wood is insufficient.
- Sterile wheatgrass will be used for temporary erosion control seeding to avoid conflicts with the permanent cover.
- Where compatible with preconstruction woody species, seeds of native woody wetland species will be incorporated into permanent erosion control seed mixes.
- If annual monitoring during the 3 years after construction indicates that disturbed wetland areas are not successfully revegetating with desirable woody plants, supplemental planting will be undertaken.

Permanent Impacts. Permanent Cowardin class changes from shrub wetland to herbaceous wetland and forested wetland to herbaceous or shrub wetland will occur as a result of Pipeline construction and maintenance. PFO and PSS wetlands will be restored in situ to the greatest extent possible. However, compensatory mitigation will be provided to compensate for the temporal loss of wetland functions. Compensation for 22.70 acres of permanent Cowardin class changes will be mitigated with offsite wetland mitigation and 4.66 acres is proposed for compensation with an in-lieu program.

Compensation for 6.91 acres of permanent Cowardin class changes in the Lower Columbia watershed will be mitigation through offsite, in-kind mitigation using the property at the mouth of the Youngs River on the west bank. The mitigation site is discussed in Section 3.4.1.

Compensation for 11.13 acres of permanent Cowardin class changes in the Nehalem, and Lower Willamette watershed will be mitigation through offsite, in-kind mitigation at the Nehalem River mitigation site.

Compensation for 4.66 acres of permanent Cowardin class in the Lower Columbia-Clatskanie watershed will be compensation with an approved in-lieu fee program will be the primary method to compensate for wetland impacts in Lower Columbia/Clatskanie watershed. Compensatory wetland mitigation plans are discussed below.

Offsite Wetland Mitigation for Permanent Cowardin Class Changes. To offset unavoidable permanent Cowardin class changes to approximately 11.13 acres of wetlands associated with the Pipeline segments in the Nehalem and Lower Willamette River basin, Oregon LNG is working with property owners to restore, create, and enhance approximately 75 acres of wetland habitat in the floodplain at a site adjacent to the Nehalem River in the Nehalem subbasin (Figure 2). The property contains a large remnant river oxbow with an outlet to the Nehalem River. Much of the property consists of a monoculture of reed canary grass and is used for grazing cattle. A ratio of 1:1 restoration, 3:1 for enhancement, and 1:5:1 of wetland creation is proposed.

This mitigation site provides conservation opportunities aligned with the strategy goals for the Coast Range and Willamette Valley ecoregions documented in *The Oregon Conservation Strategy* (Oregon Department of Fish and Wildlife [ODFW], 2008). The location of the proposed mitigation site is unique in that plant assemblages observed onsite are found in both the western Willamette Valley and the foothills of the eastern side of the Coast Range. The site contains forested communities that may be the most western outliers for their distribution range. A number of the communities identified onsite are listed by the Oregon Biodiversity Information Center as G2S2 or “imperiled because of rarity with 6-20 occurrences or few remaining acres both globally and within the state” (Kagan et al., 2004).

Mitigation objectives for the site include the following:

- **Floodplain enhancement and forest restoration**. The floodplain is mowed and grazed annually. Mitigation would create additional wetlands within the floodplain, which would retain floodwater and slow the velocity of the water flowing back into the river as floodwaters recede. Floodplain forest would be restored by replanting native species. Mitigation objectives are to expand and restore the floodplain forest and scrub-shrub communities.
- **Salmon restoration and enhancement**. Ecological goals include increasing the quantity and quality of off-channel juvenile salmonid habitat for Nehalem River salmonid populations. The Nehalem River is a major river in the northern Coast Range that flows into the Pacific Ocean at the Nehalem Bay estuary. The river provides habitat for spring and fall run Chinook salmon, coho salmon, and winter steelhead (StreamNet, 2013). Salmon fry access the site via the remnant oxbow tributary during annual freshets and become entrapped within the reed canary grass. Mitigation objectives include the establishment of slow-water salmonid refugia that contains high-quality habitat. Site modifications would restore necessary contours and reestablish native vegetation.
- **Wildlife habitat and plant species expansion**. Mitigation objectives are to increase PFO and PSS wetland habitat through wetland restoration, creations, and enhancement; increase the variety of plant species and communities; and increase structural diversity within the existing communities.

In-lieu Fee Programs for Permanent Impacts. There are no known mitigation banks with forested wetland components located in the Lower Columbia/Clatskanie subbasins. Compensatory mitigation for these impacts would occur through in-lieu fee programs. Oregon LNG will coordinate with local watershed councils to implement mitigation at multiple sites. Mitigation will focus on rehabilitating impaired functions within watersheds that will improve fish and wildlife habitat. Sites with the following characteristics will be identified for wetland mitigation: floodplain habitat where native plant diversity has been lost as a result of invasion of non-native species; riparian areas that no longer function as wetlands because they were drained by down-cutting of stream beds; locations where stream sinuosity can be restored to enhance riparian wetlands; and locations where beaver-like marshes can be restored.

Once potential appropriate sites are identified, negotiations with the respective landowners will commence, followed by: site data collection; draft mitigation site design; DSL, USACE, and EPA coordination and review; and final mitigation site design. Detailed mitigation planning will progress during agency and public review processes and will be completed prior to issuance of removal-fill permits, in keeping with the permit processing.

Chapter 4—References

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Figures

Figures

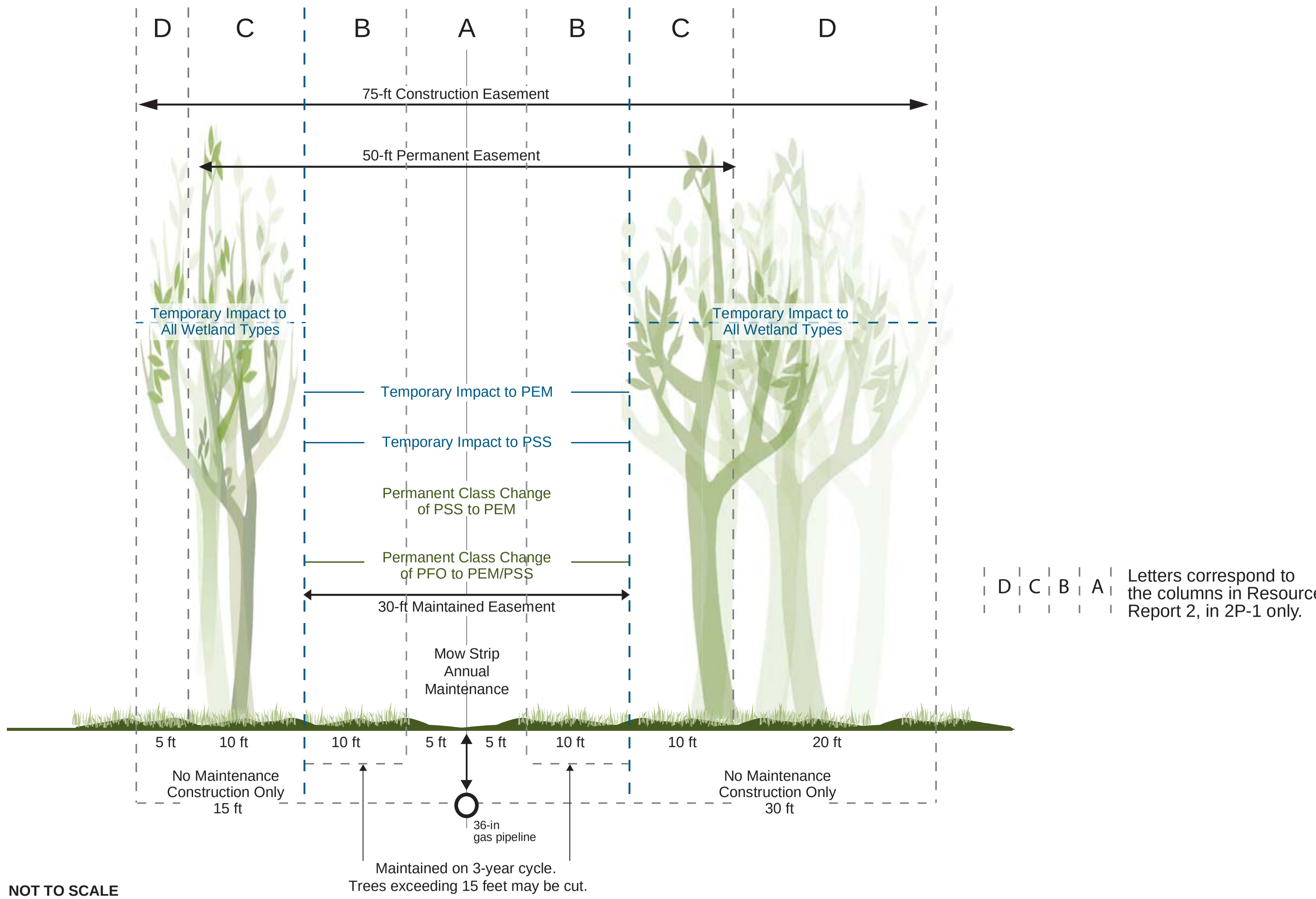


FIGURE 1
Typical Wetland Crossing Impacts

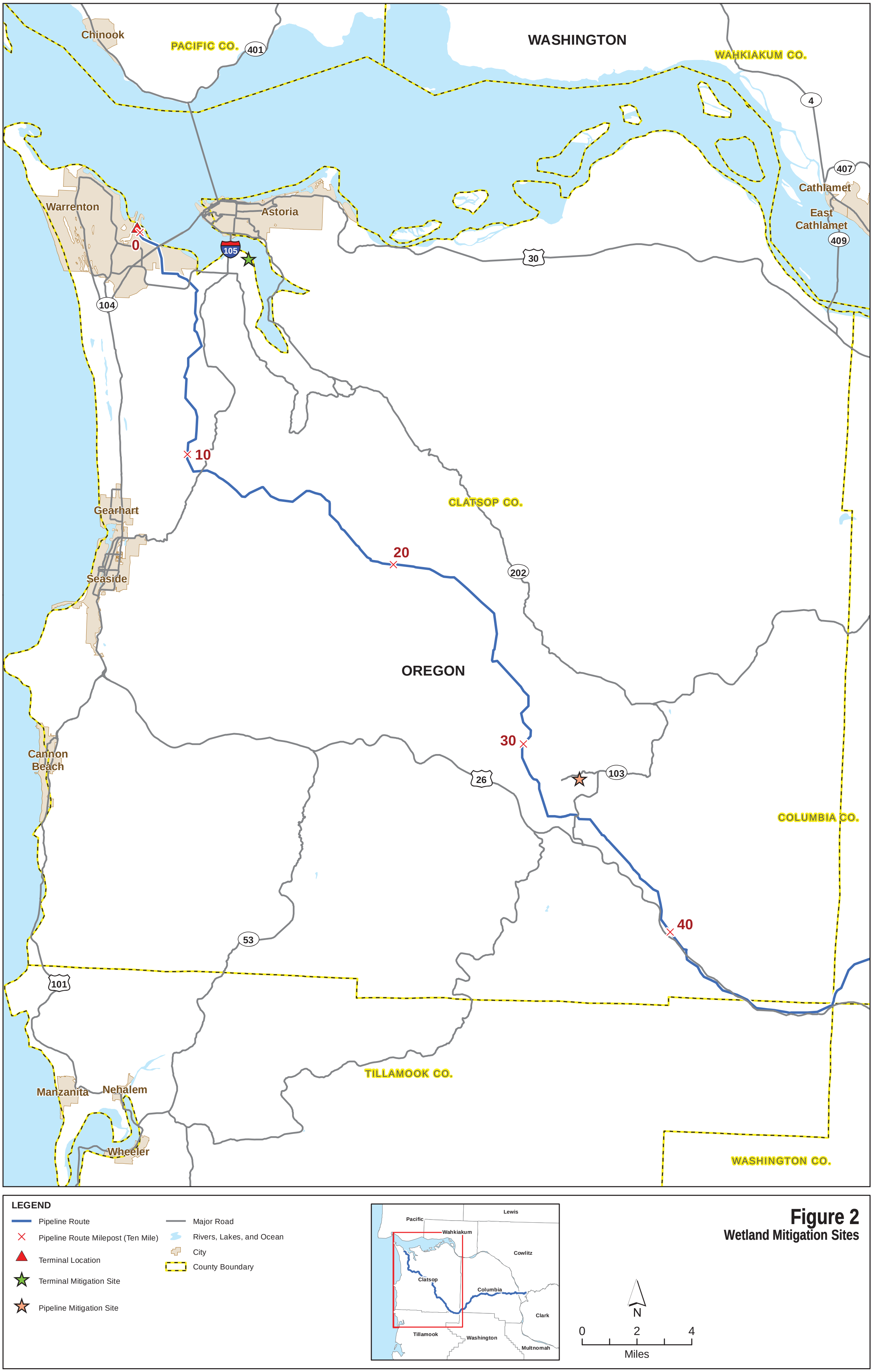
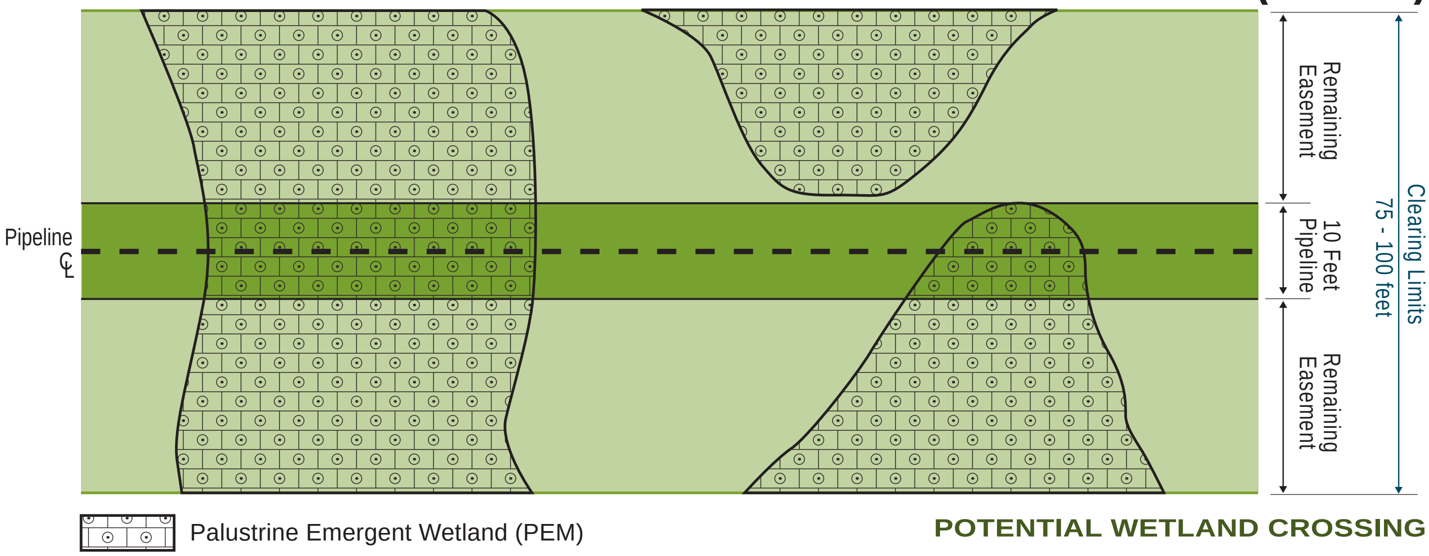


Figure 2
Wetland Mitigation Sites

Lower Columbia Watershed (4th HUC)



POTENTIAL WETLAND CROSSING

SEED MIX #1 SEED MIX FOR COASTAL LOWLANDS — NON-AGRICULTURAL

Common Name	Scientific Name	Form*	Pounds per Acre Per Live Seed (PLS)
Pacific Reedgrass	*Calamagrostis nutkaensis*	Seed	8
Seaside Arrow Grass	*Triglochin maritima*	Seed	8
Fowl Bluegrass	*Poa palustris*	Seed	8
Tufted Hairgrass	*Deschampsia caespitosa var. artica*	Seed	2
Red Fescue	*Festuca rubra*	Seed	8
Lyngby's Sedge	*Carex Lyngbyei*	Seed	10
Baltic Rush	*Juncus articus var. baticus*	Seed	10

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

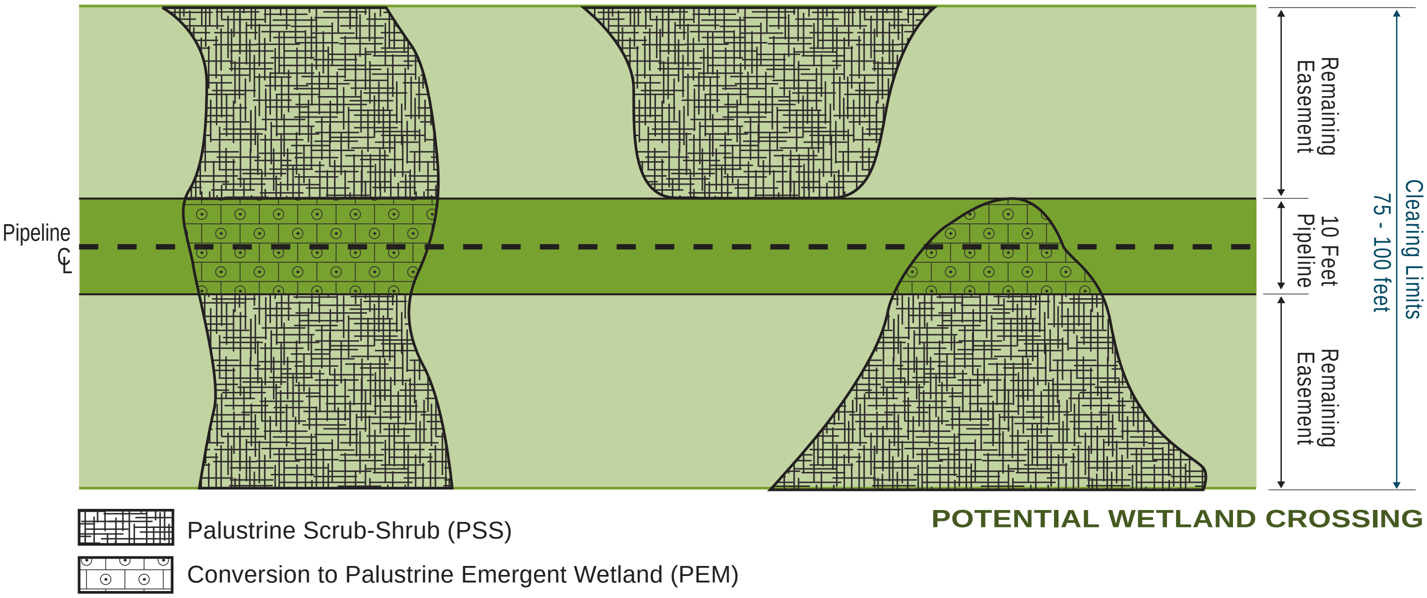
SEED MIX #2 SEED MIX FOR COASTAL FOOTHILLS — NON-AGRICULTURAL

Common Name	Scientific Name	Form*	Pounds per Acre Per Live Seed (PLS)
Red Fescue	*Festuca rubra*	Seed	8
Colonial Bentgrass	*Agrostis capillaris*	Seed	8
Slender Hairgrass	*Deschampsia elongata*	Seed	2
Slough Sedge	*Carex obnupta*	Seed	10
Small-fruited Bulrush	*Scirpus microcarpus*	Seed	10
Sickle-leaved Rush	*Juncus ensfolius*	Seed	10

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 3
Lower Columbia Watershed
Palustrine Emergent Wetland Restoration - Typical
OREGON PIPELINE PROJECT

Lower Columbia Watershed (4th HUC)



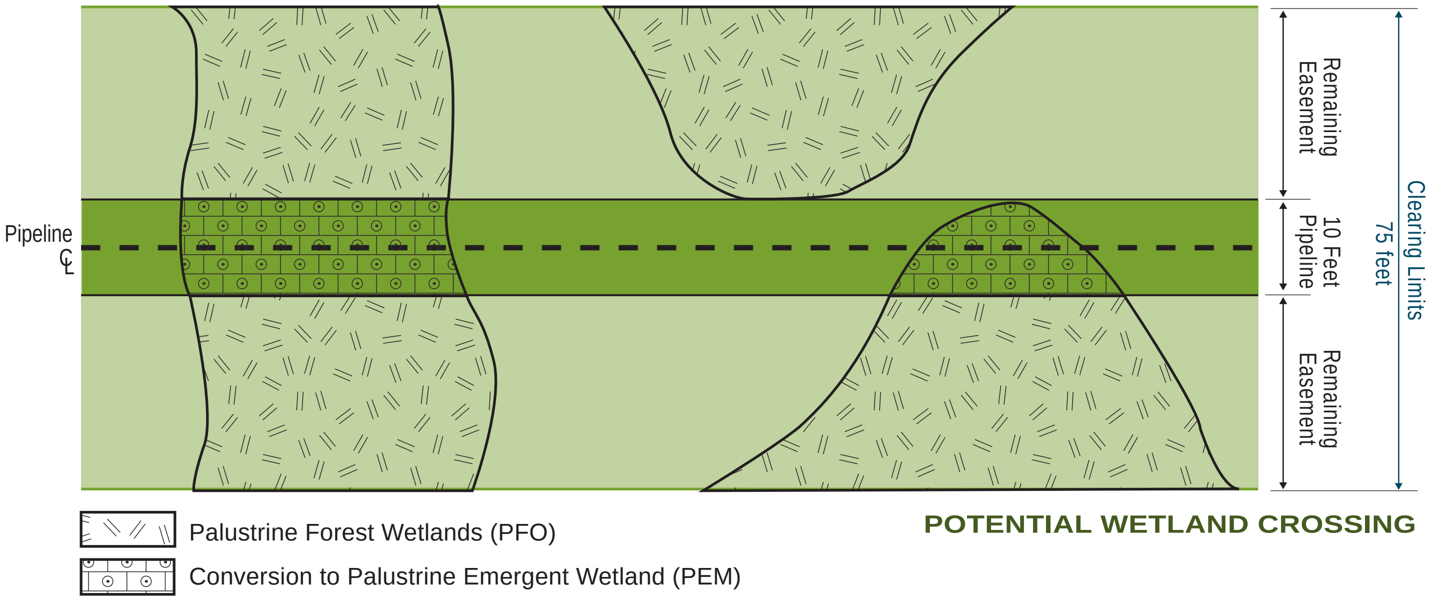
SCRUB-SHRUB WETLAND COMMUNITY - SHRUBS, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Hooker Willow	*Salix hookeriana*	Live stake	8' o.c. (4 stakes/hole)
Douglas Spiraea	*Spiraea douglasi*	1 gal	6' o.c. Cluster of 9
Wetland Seed Mix #1 for Coastal Lowland/ Wetland Seed Mix #2 for Coastal Foothills			

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 4
Lower Columbia Watershed
Palustrine Scrub-Shrub Wetland Restoration - Typical
OREGON PIPELINE PROJECT

Lower Columbia Watershed (4th HUC)



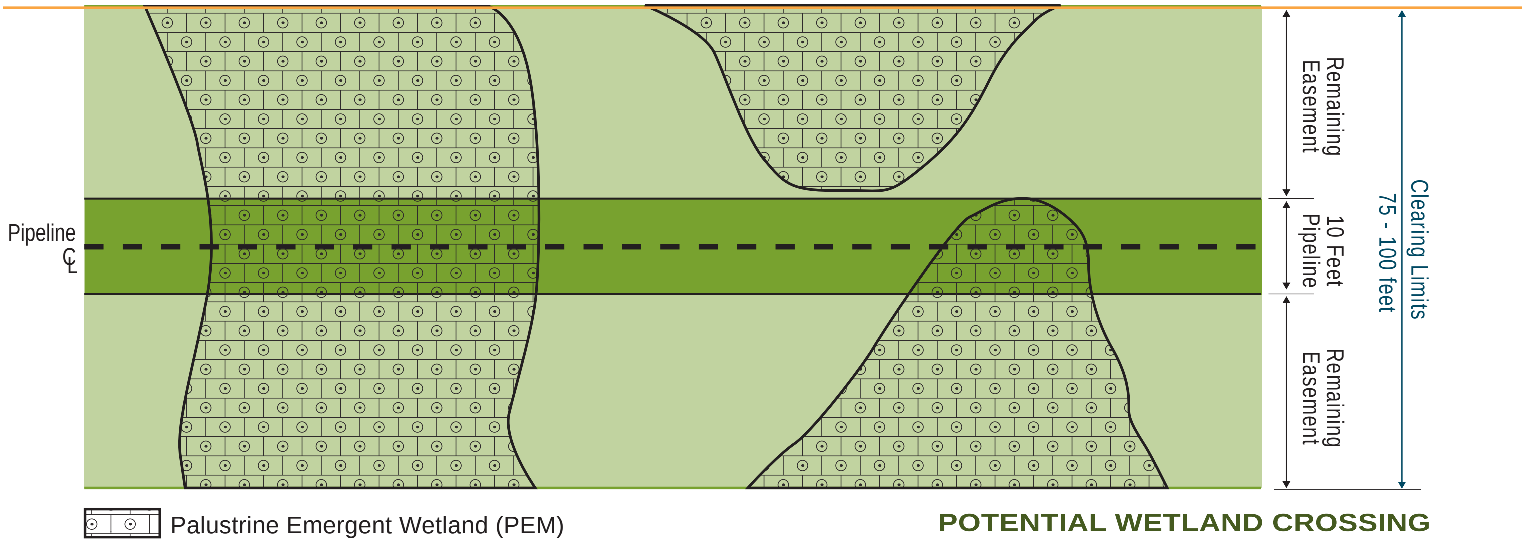
SEED MIX #1 FOREST WETLAND COMMUNITY - FOREST, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Red Alder	*Alnus Rubra*	2 gal	10’ o.c.
Western Red Cedar	*Thuja plicata*	2 gal	15’ o.c.
Sitka Spruce	*Picea sitchens*	2 gal	20’ o.c.
Wetland Seed Mix #1 for Coastal Lowland/ Wetland Seed Mix #2 for Coastal Foothills			

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 5
Lower Columbia Watershed
Palustrine Forest/Palustrine Emergent
Wetland Restoration - Typical
OREGON PIPELINE PROJECT

Nehalem Watershed (4th HUC)
Lower Columbia/Clatskanie
Lower Willamette Watershed



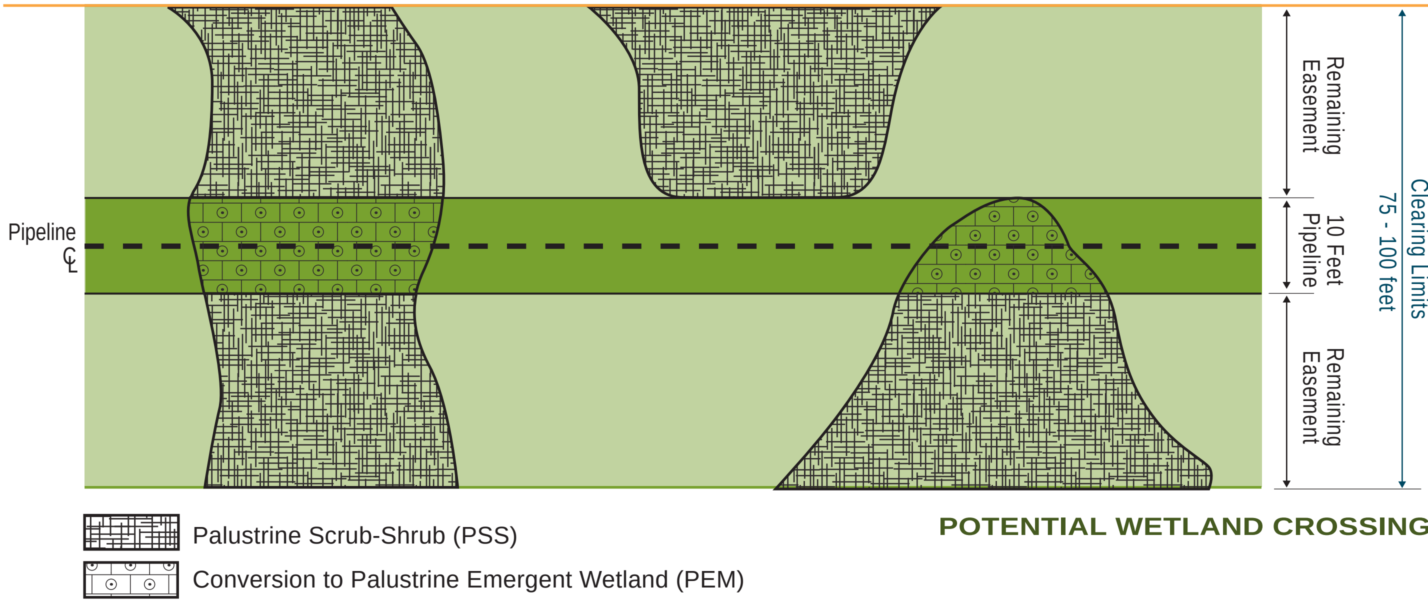
WETLAND SEED MIX #3

Common Name	Scientific Name	Form*	Pounds per Acre Per Live Seed (PLS)
Red Fescue	*Festuca rubra*	Seed	8
Colonial Bentgrass	*Agrostis capillaris*	Seed	8
Slender Hairgrass	*Deschampsia elongata*	Seed	2
Slough Sedge	*Carex obnupta*	Seed	10
Small-fruited Bulrush	*Scirpus microcarpus*	Seed	10
Sickle-leaved Rush	*Juncus ensfolius*	Seed	10

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 6
Nehalem Watershed
Palustrine Emergent Wetland Restoration - Typical
OREGON PIPELINE PROJECT

Nehalem Watershed (4th HUC)
Lower Columbia/Clatskanie
Lower Willamette Watershed



POTENTIAL WETLAND CROSSING

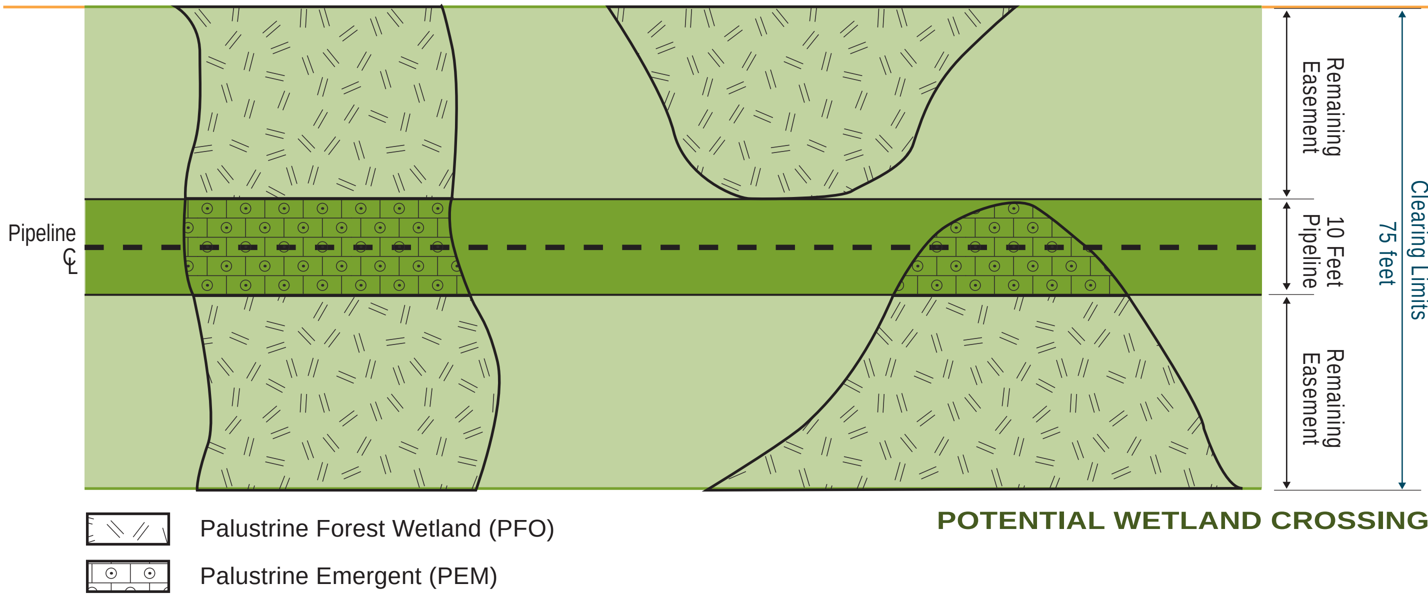
SCRUB-SHRUB WETLAND COMMUNITY - SHRUBS, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Red-osier Dogwood	*Cornus stolonifera*	1 gal	8-ft o.c. Cluster of 10
Salmonberry	*Rubus spectabilis*	1 gal	6-ft o.c. Cluster of 12
Wetland Seed Mix #3			

** Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 7
Nehalem Watershed
Palustrine Scrub-Shrub Wetland Restoration - Typical
OREGON PIPELINE PROJECT

Nehalem Watershed (4th HUC)
Lower Columbia/Clatskanie
Lower Willamette Watershed



POTENTIAL WETLAND CROSSING

FOREST WETLAND COMMUNITY - FOREST, HERBS

Common Name	Scientific Name	Form*	Spacing (on center)
Red Alder	*Alnus rubra*	2 gal	10' o.c.
Western Red Cedar	*Thuja plicata*	2 gal	15' o.c.
Sitka Spruce	*Picea sitchens*	2 gal	10' o.c.
Wetland Seed Mix #3			

* *Substitution of species or substitution of plugs for seeds may be made, depending on availability and approval by Permitting Agency.*

FIGURE 8
Nehalem Watershed
Palustrine Forest/Palustrine Emergent
Wetland Restoration - Typical
OREGON PIPELINE PROJECT

Appendix F5

Technical Memorandum: Oregon LNG Pipeline Waterbody Crossing—Fish Salvage Plan

Oregon LNG Pipeline Waterbody Crossing: Fish Salvage Plan

PREPARED FOR: Oregon LNG—Resource Report 3

COPY TO: Jay Lorenz/CH2M HILL

PREPARED BY: Greg White/CH2M HILL

DATE: May 21, 2013

Introduction

The construction of the proposed Oregon LNG Pipeline from the Terminal at Warrenton to existing infrastructure near Woodland, Washington, will cross approximately 235 freshwater systems. Crossing methods that require in-water activities and dry crossing methods may require fish salvage activities. This technical memorandum describes the crossing methods that will potentially involve fish salvage activities, as well as the measures that will be implemented to conduct fish salvage activities where required.

Waterbody Crossing Methods

In part, the waterbody type, width, fish species usage, geography, and engineering feasibility will determine the crossing method employed. Potential crossing methods include Dam-and-Pump, Open-cut, Flume, and Horizontal Directional Drilling (HDD). Intermittent and ephemeral waterbodies will likely be dry during the crossing construction period and, therefore, fish will not be present. These waterbodies will be crossed using the Open-cut method and will not require fish salvage. However, if water is present at the time of construction, the presence of fish will be determined before construction below the ordinary high water elevation. If fish are present, fish salvage activities will be conducted prior to construction activities.

Waterbody crossings that employ HDD will not require fish salvage activities because no in-water activities will occur. The only waterbody crossing methods that will require potential fish salvage are those that isolate the construction area from the actively flowing waterbody, thereby dewatering a portion of the waterbody and potentially stranding fish. HDD and de-watered waterbodies are called “dry construction” methods. The dry construction methods that would require potential fish salvage activities are the Dam-and-Pump and Flume crossing methods.

Dam-and-Pump Crossing Method

The Dam-and-Pump crossing method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and where there are no concerns regarding fish passage. The Dam-and-Pump crossing method was considered. However, it is not proposed in this filing. If it is used, implementation of the Dam-and-Pump crossing method will meet the following performance criteria:

- Use sufficient pumps, including onsite backup pumps, to maintain downstream flows.
- Construct dams with materials that prevent sediment and other pollutants from entering the waterbody (for example, sandbags or clean gravel with plastic liner).
- Screen pump intakes.
- Prevent streambed scour at pump discharge.
- Monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.

Flume Crossing Method

The Flume crossing method is the proposed method of choice and will require implementation of the following steps:

- Install flume pipe before any trenching.
- Use sandbag or sandbag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert streamflow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal).
- Properly align flume pipe(s) to prevent bank erosion and streambed scour.
- Do not remove flume pipe during trenching, pipe laying, or backfilling activities, or during initial streambed restoration efforts.
- Remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the streambed and bank is complete.

Authorizations

Crossing methods that involve in-water or in-channel work will be constructed during the designated Oregon Department of Fish and Wildlife (ODFW) in-water work window (ODFW, 2008) or authorized Washington State Department of Fish and Wildlife (WDFW) in-water work timing unless specific written authorization stating otherwise is provided. The ODFW in-water work windows for waterbodies to be crossed by the Pipeline are provided in Attachment 1. The WDFW does not have designated in-water work windows, and each crossing of Burris Creek or its tributaries will be negotiated with WDFW. In-water work window guidelines minimize potential adverse impacts to fish and wildlife and their habitats. They also avoid sensitive life stages, including spawning, rearing, and migration.

Before fish salvage activities are conducted at all stream crossings, ODFW/WDFW/National Marine Fisheries Service (NMFS) Scientific Taking Permits will be obtained for all species that may be encountered at any of the crossing areas, including species listed under the federal Endangered Species Act (ESA).

A qualified fisheries biologist will be onsite to oversee and conduct all fish salvage operations. Any fish or lampreys that are captured will be handled according to requirements in the Scientific Taking Permits and will generally involve the following procedures:

- Before and intermittently during isolation of the in-water work area, capture fish trapped in the area by using a trap, seine, electrofishing, or other methods as are prudent to minimize risk of injury, and then release them at a safe release site.
- Do not use electrofishing if water temperatures exceed 18 degrees Celsius (°C) or are expected to rise above 18°C, unless no other method of capture is available.
- Take fish by backpack electrofishing, seining, or other approved method. If electrofishing equipment is used to capture fish, comply with NMFS electrofishing guidelines (NMFS, 2000).
- Handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.
- Ensure that water quality conditions are adequate in buckets or tanks used to transport fish by providing circulation of clean, cold water; using aerators to provide dissolved oxygen; and minimizing holding times.
- Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.
- Do not transfer ESA-listed fish to anyone except NMFS personnel, unless otherwise approved in writing by NMFS.

- Allow NMFS or its designated representative to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities. Submit an electronic copy of the Salvage Report Form to NMFS within 10 calendar days of completion of the salvage operation.
- Rescue/salvage (take) of fish during isolation of in-water work areas at Pipeline waterbody crossings will include handling of adults and/or juveniles. All fish handled must be recorded in the annual report for the Scientific Taking Permit.
- In-water work (fish salvage or construction) may occur between the specific designated in-water, or negotiated, work windows for each specific waterbody. Exceptions to these in-water work periods must be approved by the local ODFW/WDFW District Fish Biologist or his/her representative and submitted to the ODFW ESA Program Specialist or WDFW District Biologist, in writing, before work commences outside the approved in-water work windows.
- Activities must be coordinated with the local ODFW/WDFW District Fish Biologist prior to any sampling.
- Indirect mortality may not exceed 10 percent of the total take, or—for species listed under the federal ESA—up to a specified number of individuals. In the event that mortality for any species exceeds the specified rate, the permittee will contact the ESA Program Specialist, ODFW, and/or WDFW prior to any further activity.

Waterbodies with Fish Salvage Requirements

Waterbodies to be crossed using the Open-Cut, Flume, Dam-and-Pump, or HDD methods are provided in Attachment 2. It is assumed that fish will not be present in intermittent or ephemeral streams, which will be Open-Cut. However, if water is present at an intermittent or ephemeral crossing, the presence of fish will be determined prior to construction below the ordinary high water elevation and fish salvage activities will be conducted, if necessary.

Named streams that are known to support anadromous salmonids in the Northern Oregon Coastal basins, Oregon lower Columbia River tributaries, and Washington lower Columbia River tributaries will be crossed using the Flume crossing method. These streams are listed in Table 1.

TABLE 1

Anadromous Fish and Resident Salmonid Species Documented at Proposed Flume Pipeline Crossing Sites in the Northern Oregon Coastal Streams and Rivers, Oregon Lower Columbia River Tributaries, and Washington Lower Columbia River Tributaries[a]

Pipeline Milepost	River or Creek Crossed	Fish Species Present[b]	
		Anadromous Salmonids	Resident Salmonids[b]
1.5	Vera Creek	Coho salmon	Unknown, presumed present[c]
4.5	Barrett Slough	Coho salmon	Unknown, presumed present[c]
7.9	Heckard Creek	Coho salmon	Unknown, presumed present[c]
11.0	Lewis and Clark River	Fall Chinook salmon, coho salmon, , winter steelhead trout	Unknown, presumed present[c]
18.5	Rock Creek	No anadromous fish (barrier downstream)	Coastal cutthroat trout
19.3	Osgood Creek	No anadromous fish (barrier downstream)	Coastal cutthroat trout
20.1	Fox Creek	No anadromous fish (barrier downstream)	Coastal cutthroat trout
21.4	South Fork Youngs River	No anadromous fish (barrier downstream)	Coastal cutthroat trout
23.4	Fall Creek	No anadromous fish (barrier downstream)	Coastal cutthroat trout
31.4	Alder Creek	Coho salmon	Unknown, presumed present[c]
47.6	North Fork Wolf Creek	Spring Chinook salmon, coho salmon, winter steelhead trout	Unknown, presumed present[c]
50.5	Clear Creek	Coho salmon	Unknown, presumed present[c]

TABLE 1
Anadromous Fish and Resident Salmonid Species Documented at Proposed Flume Pipeline Crossing Sites in the Northern Oregon Coastal Streams and Rivers, Oregon Lower Columbia River Tributaries, and Washington Lower Columbia River Tributaries[a]

Pipeline	River or Creek Crossed	Fish Species Present[b]	
55.7	Cedar Creek	Coho salmon	Unknown, presumed present[c]
70.7	Clatskanie River	Coho salmon, winter steelhead trout	Unknown, presumed present[c]
71.8	Little Clatskanie River	Coho salmon	Unknown, presumed present[c]

[a] Northern Oregon Coastal Basins include the Lower Columbia and the Nehalem basins along the pipeline route.

[b] Sources: anadromous species—StreamNet and Kostow, 1995; resident species—Kostow, 1995; Kavanaugh et al., 2005.

[c] Although no documentation confirming the presence of resident cutthroat trout was identified, because of their wide distribution, they are likely present in most of the crossed streams but are assumed present in all.

Many perennial named and unnamed streams that the Pipeline will cross are likely to support resident coastal cutthroat trout and/or nongame fish species such as sculpin. Perennial streams are assumed to support fish and will require fish salvage at the crossing site.

Fish Salvage Procedures

Fish species likely to be encountered during fish salvage activities include salmonids (salmon and trout, including salmon and trout listed under the federal ESA), cyprinids (minnows), cottids (sculpins), gasterosteids (sticklebacks), acipenserids (sturgeons), petromyzontids (lampreys), catostomids (suckers), ictalurids (catfish), and centrarchids (sunfish and bass).

Fish will be salvaged using backpack electrofishing equipment, traps, seines, or other approved methods. If electrofishing equipment is to be used and potential ESA species may be present, NMFS electrofishing guidelines will be followed (NMFS, 2000; Attachment 3). Electrofishing is the most appropriate method for capturing lamprey ammocoetes (larvae) during salvage activities. Traps can be used, but they typically capture lampreys as they migrate upstream or downstream.

A qualified fisheries biologist will be onsite to oversee and conduct all fish salvage operations. All crossings will be constructed during the ODFW in-water work window or WDFW negotiated in-water construction timing period unless specifically authorized in writing by ODFW or WDFW. Because lampreys may be present at waterbody crossings, special salvage procedures have been incorporated into this fish salvage plan to account for the capture of lamprey ammocoetes or other larval stages (see 2[a] below).

In general, the following steps will be conducted during salvage activities at crossing sites:

1. Set block nets upstream and downstream of the area to be crossed to ensure that fish or lampreys cannot enter the construction area.
2. Conduct the salvage between the block nets by using electrofishing equipment, seine, trap, or other approved method. If using electrofishing equipment, a minimum two-pass method will be employed to ensure that all fish and lampreys are captured. Electrofishing equipment is the most appropriate method for capturing larval lamprey during salvage activities at crossing sites.
    a. The first electrofishing pass of the minimum two-pass method will be specifically for capturing larval lamprey. The electrofishing unit will be set to deliver three pulses/second (125 volts direct current [dc]) at 25 percent duty cycle, with a 3:1 burst pulse train (three pulses on, one pulse off) to remove larvae from the substrate (U.S. Fish and Wildlife Service [USFWS], 2002). Once larvae emerge, 30 pulses/second will be applied to stun the larvae.
    b. The second and subsequent electrofishing passes will be to capture fish that may be in the area and were not captured during the first electrofishing pass. The electrofishing unit will be set accordingly to deliver

the appropriate pulse rate/second at the appropriate voltage and duty cycle based in part on fish size, streamflow, velocity, depth, temperature, and conductivity.

3. Captured fish and lampreys will be handled to the minimal extent possible and placed in containers of clean, aerated water. Individuals will be held in containers for the minimal time necessary. All captured individuals will be enumerated, identified, and noted in a field logbook prior to being released. Captured individuals will be released into a safe site as quickly as possible, and as near as possible to capture sites.
4. After fish and lampreys have been captured in the construction area, install the flume or dam-and-pump equipment.
5. Inspect the isolated area for stranded fish or lampreys and salvage if necessary.

Construct crossing, restore waterbody channel, and remove flume equipment to restore flow in the construction area per the guidelines below:

1. Apply the method to waterbodies where downstream siltation must be avoided. Flumes are generally not recommended for use on waterbodies with a broad unconfined channel, permeable substrate, excessive discharge, or where a significant amount of bed or bank alteration is required to install flumes or dams.
2. Schedule crossing during low-flow period, if possible.
3. Complete all watercourse activities as expediently as possible. However, in accordance with Federal Energy Regulatory Commission (FERC) procedures, the duration of construction will be limited to 24 hours across minor waterbodies (10 feet wide or less) and 48 hours across intermediate waterbodies (between 10 and 100 feet wide).
4. Do not refuel mobile equipment within 150 feet of a waterbody. Refuel stationary equipment per the Spill Prevention, Control, and Countermeasures Plan (Resource Report 2 [CH2M HILL, 2013], Appendix 2H).
5. Minimize riparian clearing to accommodate stream size, terrain, and existing vegetation conditions, and to avoid removal of significant trees, where possible, at the margins of the temporary construction zone. Existing large woody debris will be salvaged for reinstallation, and a sufficient quantity of large-diameter conifer logs will be stockpiled for post-construction aquatic habitat enhancement.
6. Install temporary equipment crossing.
7. In agricultural land, strip topsoil from spoil storage area.
8. Store instream spoil on banks a minimum of 25 to 50 feet from the top of the bank.
9. Leave hard plugs at the stream bank edge until just prior to pipe installation.
10. Size the flume to handle 150 percent of the anticipated flows. Install the flume in the watercourse and maintain the correct alignment until it is removed.
11. Construct an upstream dam followed by a downstream dam. Install a flange on the upstream end of the flume and seal it to substrate with sandbags and polyethylene liner where necessary to ensure a watertight barrier. “Key” dams into banks or construct a secondary dam, if necessary.
12. Pump stream channel between the dams, if necessary. Discharge water through a dewatering structure and onto a stable, well-vegetated area to prevent erosion and sedimentation. Do not discharge heavily silt-laden water in the stream.
13. Construct sediment barriers (straw bales and/or silt fences) to prevent silt-laden water and spoil from flowing back into the watercourse. Constructed sediment barriers shall extend along the sides of the stockpiles and the ends of dams. Barriers may be temporarily removed to allow construction activities but must be replaced by the end of each work day.
14. Complete prefabrication of the instream pipe section and weight the pipe, as necessary, prior to commencement of instream activity.

15. Trench through the watercourse. Install temporary (soft) plugs, if necessary, to control water flow and trench sloughing.
16. Maintain streamflow, if present, through the flume throughout crossing construction.
17. Lower-in the pipe, install the trench plug, and backfill immediately.
18. Backfill with native material.
19. Restore the watercourse channel to the approximate preconstruction profile and substrate.
20. Restore stream banks to their approximate original condition and stabilize them, as required.

Restoration and cleanup will begin after the trench is backfilled or as soon as weather and site conditions permit and be in accordance with landowner requests, the FERC Plan, and as described in Resource Report 2 (CH2M HILL, 2013), Appendix 2D. These fish salvage procedures will be followed at all Pipeline crossings requiring fish salvage. A field log will be kept for each fish salvage documenting the number of fish by species and age group (adult or juvenile); disposition of released fish noting any injuries or mortalities; date; salvage team members; and general observations. After all stream crossings and salvages have been completed, a report will be compiled that summarizes the number of fish salvaged by species and their disposition. This report will be submitted to ODFW/WDFW/NMFS in compliance with the ODFW/WDFW/NMFS Scientific Taking Permits.

Literature Cited

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Attachment 1
Oregon Guidelines for Timing of In-water Work to Protect Fish and Wildlife Resources

OREGON GUIDELINES FOR TIMING OF IN-WATER WORK TO PROTECT FISH AND WILDLIFE RESOURCES

June, 2008

Purpose of Guidelines - The Oregon Department of Fish and Wildlife, (ODFW), under its authority to manage Oregon's fish and wildlife resources has updated the following guidelines for timing of in-water work. The guidelines are to assist the public in minimizing potential impacts to important fish, wildlife and habitat resources.

"The guidelines are to assist the public in minimizing potential impacts...".

Developing the Guidelines - The guidelines are based on ODFW district fish biologists' recommendations. Primary considerations were given to important fish species including anadromous and other game fish and threatened, endangered, or sensitive species (coded list of species included in the guidelines). Time periods were established to avoid the vulnerable life stages of these fish including migration, spawning and rearing. The preferred work period applies to the listed streams, unlisted upstream tributaries, and associated reservoirs and lakes.

"The guidelines are based on ODFW district fish biologists' recommendations".

Using the Guidelines - These guidelines provide the public a way of planning in-water work during periods of time that would have the least impact on important fish, wildlife, and habitat resources. ODFW will use the guidelines as a basis for commenting on planning and regulatory processes. There are some circumstances where it may be appropriate to perform in-water work outside of the preferred work period indicated in the guidelines. ODFW, on a project by project basis, may consider variations in climate, location, and category of work that would allow more specific in-water work timing recommendations. These more specific timing recommendations will be made by the appropriate ODFW district office through the established planning and regulatory processes.

"These guidelines provide the public a way of planning in-water work during periods of time that would have the least impact on important fish, wildlife and habitat resources".

Modification of Guidelines - There may be limited situations where minor modification of the timing guidelines is warranted. ODFW may consider new information, the need for greater detail, or other factors that would generally improve the quality and usefulness of these guidelines. ODFW through the appropriate district office may modify or clarify timing guidelines within the district as needed. Statewide updates to guidelines will occur on a periodic basis.

"ODFW through the appropriate district office may modify or clarify timing guidelines within the district as needed".

Public Comments - A limited technical public review of these updated guidelines was conducted. A few responses provided specific biological information and recommendations for changing in-water work periods. Applicable ODFW districts reevaluated their timing recommendations based on this public response. Other comments concerned format and application of the timing guidelines. Some responses stated that different types of in-water activities should have different timing guidelines. ODFW recognizes there will be occasions that more specific timing guidelines may need to be established for specific activities. The established planning and regulatory processes can accommodate that need.

"A limited technical public review of these updated guidelines was conducted".

WATERWAY	PREFERRED WORK PERIOD [1]
Columbia River Management (971) 673-6000	
Columbia River Estuary (Mouth to Tongue Pt.)	November 1 – February 28 (MAR,SHL,CHF,CHS,SS,CO,STW,STS,CT*)
Columbia River (Tongue Pt. to Bonneville Dam)	November 1 – February 28 (CHF,CHS,SS,CO,STW,CS,CHR,CT,STS*)
Northwest Region	
North Coast Watershed District	
Tillamook Office - (503) 842-2741	
Pacific	
Columbia River (See Columbia River Management)	
Youngs River	July 15 - September 30 (CO,STW *)
Young's Bay Tributaries	July 1 – September 15 (CO,CT,STW)
Wallooskee River	June 1 - September 30 (CO,CT*)
Other Columbia R. Est. Tribs. (Mouth to Tongue Pt.)	July 1 - September 15 (CHF,STW*)
Other Columbia R. Est. Tribs (Tongue Pt. to Hunt Creek)	July 15 - September 15 (CHF, STW*)
Necanicum	
Necanicum River & tributaries	July 1 - September 15 (CO,CHF,STW*)
Necanicum and Neawanna Estuary	November 1-February 15 (MAR,SHL,CO,CHF,STW)
Ecola Creek and Tributaries	July 1-September 15 (CO,CT,STW)
Nehalem	
Nehalem Estuary	November 1 - February 15 (MAR,SHL,CHS,CHF,CO,STW,*)
Lower Nehalem River (below Hwy 26 at Elsie)	July 1 - September 15 (CHF*)
N. Fk. Nehalem River	July 1 - September 15 (CHF,STW*)
Cook Creek	July 1 - September 15 (CHF,STW*)
Salmonberry River	August 15 - September 15 (CHS,STW*)
Other Lower Nehalem River Tributaries	July 1 - September 15 (CHF,CO,STW*)
Upper Nehalem River and Tribs. (above Hwy 26 at Elsie)	July 1 - August 31 (CHS,STW*)
Tillamook	
Tillamook Estuary	November 1 - February 15 (MAR,SHL,CHF,CHS,STW,CO,CS*)
Miami,Kilchis,Wilson,Trask,Tillamook Rivers & Tribs.	July 1 - September 15 (CHF,CHS,STW,CO,CS*)
Other Tillamook Bay Tributaries	July 1 – September 15 (CO,CT)
Netarts Bay	November 1 - February 15 (MAR,SHL,CHF,STW,CO,CS*)
Sand Lake	November 1 - February 15 (MAR,SHL,CHF,STW,CO,CS*)
Nestucca	
Nestucca Estuary	November 1 - February 15 (MAR,SHL,CHF,CHS,STW,CO,CS*)

[1] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.

WATERWAY	PREFERRED WORK PERIOD [1]
Nestucca River & Tributaries	July 1 - September 15 *(CO,CHS,CHF,CS,STW*)*
Little Nestucca River & Tributaries	July 1 – September 15 (*CO,CHS,CHF,CS,STW*)
Neskowin Creek and Tributaries	July 1 - September 15 *(CO,CS,STW*)*
Other North Coastal Tributaries (Columbia River to Neskowin Cr.)	July 1 – September 15 (*CO,CT*)
Coastal Lakes	October 1 – February 15 (*CT*)
Coastal lake Tributaries	July 1 – September 15 (CT)
Newport Office - (541)-867-4741	
Pacific	
Salmon	
Salmon River Estuary	November 1 - February 15 *(MAR,SHL*)*
Salmon River	July 1 - September 15 *(CHF,CO,CS,STW,CT*)*
Siletz	
Siletz River Estuary	November 1 - February 15 (MAR,SHL*)
Siletz River	July 1 - August 31(CHF,CHS,CO,CS,STW,STS,CT*)
Yaquina	
Yaquina River Estuary	November 1 - February 15 (MAR,SHL*)
Yaquina River	July 1 - September 15 *(CHF,CO,STW,CT*)*
Alsea	
Alsea River Estuary	November 1 - February 15 (MAR,SHL*)
Alsea River	July 1 - August 31 *(CHF,CHS,CO,STW,CT*)*
Yachats River	July 1 - September 15 *(CHF,CO,STW,CT*)*
Siuslaw	
Siuslaw River Estuary	November 1 - February 15 *(MAR,SHL,CHF,CO,STW,CT*)*
Siuslaw River	July 1 - September 15 *(CHF,CO,STW,CT*)*
Other Coastal Tributaries	July 1 - September 15 *(CO,STW,CT*)*
Coastal Lakes	October 1 – February 15 (*STW,CO,CT*)
Coastal Lake Tributaries	July 1 – September 15 (STW,CO,CT)

North Willamette Watershed District

Clackamas Office (971) 673-6000	
Columbia	
Columbia River (Hunt Creek to Bonneville Dam) See Columbia River Management	
Columbia River (Within District above Bonneville Dam)	November 15 - March 15 *(CHF,CHS,CHR,SS,CO,CS,STW,STS,CT*)*
Columbia R. Tribs. (Hunt Creek to St. Helens)	July 15 - September 15 *(CHF,STW*)*
Clatskanie River	July 15 - September 15 (CHF,STW*)

[1] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.

WATERWAY	PREFERRED WORK PERIOD [1]
Willamette	
Multnomah Channel (including Scappoose Bay)	July 1 - October 31 & December 1 - January 31[2] (CHF,CHS,CO,STW,STS,CT,WW *)
Milton Cr. & Scappoose Cr.	July 15 - August 31 (CO,STW,JUV,WW*)
Willamette River (mouth to Willamette Falls)	July 1 - October 31 & December 1 - January 31[3] (CHF,CHS,CO,STW,STS,CT,WW *)
Columbia Slough	June 15 - September 15 (JUV,WW)
Johnson	
Johnson Creek	July 15 - August 31 (STW,CO,CT,CHF*)
Johnson Cr. Tribs.	July 15 - August 31 (CT,STW,CHF,CO*)
Kellogg Creek	July 15 - September 30 (STW,CO,CT*)
Tryon Creek	July 15 - September 30 (STW,CO,CT*)
Clackamas River	July 15 - August 31 (CHF,CHS,STW,CO,STS,CT*)
Abernethy Creek	July 15 - September 30 (CO,STW,CT*)
Other Willamette River tribs.	July 15 – September 30 (CT*)
Willamette River (Will. Falls to Newberg)	June 1 - October 31 & December 1 - January 31 (CHS,STW*)
Tualatin	
All Tualatin River Tributaries	July 15 - September 30 (CO,STW,CT,WW*)
Tualatin River (below Scoggins Cr.)	June 1 - September 30 (CO,STW,CT,WW*)
Tualatin River (above Scoggins Cr.)	July 15 - September 30 (CO,STW,CT,WW*)
Beaver Creek	July 15 - September 30 (CT*)
Molalla/Pudding River	
Molalla River (below Hwy 213)	June 1 – September 30 (STW,CT*)
Other Molalla River Tributaries (below Hwy 213)	July 15 - September 30 (CT*)
Molalla River (above Hwy 213)	July 15 - August 31 (CHS,STW,CT,RB*)
N. Fk & M. Fk Molalla	July 15 - August 31 (CHS,STW,CT,RB*)
Other Molalla River Tributaries (above Hwy 213)	July 15 - September 30 (STW,CT*)
Pudding River	June 1 - September 15 (CHS,STW,CT*)
Butte Creek	July 15 - September 30 (STW,CT*)
Abiqua Creek	July 15 - August 31 (CHS,STW,CT,RB*)
Silver Creek	July 15 - September 30 (STW,CT*)
Other Pudding River Tributaries	June 1 - September 30,STW,CT,RB*)
Other Willamette River tribs.	July 15 – October 15 (CT*)
Willamette River (Newberg to Yamhill River)	June 1 – September 30 (CHS,STW,CT,RB*)
Chehalem Creek	July 15 - September 30 (CT*)
Yamhill River	July 15 - September 30 (STW,CT*)
Other Willamette River tribs.	July 15 – September 30 (CT*)
Fairview Cr.,Arata Cr., Salmon Cr.	June 15 - September 15 (CT,WW*)
Sandy River	July 15 - August 31 (CHS,CHF,CO,STW*)
Tanner Creek	July 15 - August 15 (CHF,CHS,CO,STW*)
Columbia River Tributaries (St. Helens to Sandy River)	July 15 - August 31 (CHF,CO,STW,CT *)
Columbia River Tributaries (Sandy River to Herman Cr.)	July 15 - August 31 (CO,STW,STS,CT *)

[1] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.
[2] Winter window only for activities below -20'Columbia River Datum
[3] Winter window only for activities below -20' National Geodetic Vertical Datum 1947

WATERWAY	PREFERRED WORK PERIOD [1]
South Willamette Watershed District	
Corvallis Office - (541) 757-4186	
Willamette	
Willamette River (Yamhill River to McKenzie River)	June 1 – October 15 (CHS,STW,CT,RB*)
Spring Valley Creek	July 1 - October 15 (CT*)
Glenn Creek	July 1 - October 15 (CT*)
Mill Creek	June 1 – October 15 (CT,RB*)
Rickreall Creek	July 1 – October 15 (STW,CT*)
Luckiamute River	July 1 - October 15 (STW,CT*)
Santiam River	June 1 – October 15 (CT*)
North Santiam River (below Big Cliff Dam)	July 15 - August 31 (CHS,STW,CT,RB*)
Stout Cr., Rock Cr., & Mad Cr.	July 15 - October 15 (STW,CT,RB*)
Lt. N. Fk. Santiam River	July 15 - August 31 (CHS,STW,CT,RB*)
Sinker, Elkhorn Cedar Creeks & tributaries	July 15 - October 15 (STW,CT,RB*)
Other Tributaries	June 1 - October 15 (CT*)
Other Santiam River Tributaries (below Big Cliff Dam)	June 1 - October 15 (CT*)
North Santiam River (above Detroit Dam)	June 1 - August 31 (CHS, K,CT,RB*)
Breitenbush River	June 1 - August 31 (CHS, K,CT,RB*)
South Santiam River (below Foster Dam)	July 15 - August 31 (CHS,STW,CT,RB*)
Crabtree Cr.,Thomas Cr. & Wiley Cr.	July 15 - August 31 (CHS,STW,CT,RB*)
McDowell Cr.	July 15 - October 15 (STW,CT*)
Other South Santiam River Tributaries (below Foster Dam)	June 1 - October 15 (CT*)
South Santiam River (above Foster Dam)	July 15 - August 31 (CHS,STW,CT,RB*)
Middle Santiam River & Quartzville Creek	June 1 - October 15*(K,CT,RB*)
Marys River	July 1 - October 15 (CT*)
Long Tom River	July 1 - October 15(CT*)
Other West Bank Will. R. Tribs. (Will. Falls to McKenzie R.)	July 1 - October 15 (CT*)
Calapooia	
Calapooia River (below Holley)	June 1 - October 15 (CT*)
Calapooia River (above Holley)	July 15 - August 31 (CHS,STW,CT,RB*)
Other East Bank Will. R. Tribs. (Will. Falls to Harrisburg)	June 1 - October 15 (CT*)
Springfield Office - (541) 726-3515	
Willamette	
Willamette River (above McKenzie River)	June 1 - October 31(CHS,RB*)
McKenzie River Basin	
McKenzie River (below Leaburg Dam)	by specific arrangement (CHS,CT,RB,BUT,OC*)
Tributaries of McKenzie River (below Leaburg Dam)	June 1 - October 31 (CT,RB, OC*)
McKenzie River (above Leaburg Dam)	July 1 - August 15 (CHS,BUT,CT,RB*)
Blue River (above Blue River Dam)	June 1 - October 31 (CT,RB*)
Middle Fork Willamette River Basin	
Middle Fork Willamette River (Confluence with the Coast Fork Willamette to Dexter Dam)	by specific arrangement (CHS,STW,CT,RB,OC*)
Fall Creek & Little Fall Creek	July 1 - August 31 (CHS,STW,CT,RB*)
Lost Creek	July 1 - August 31 (CHS,STW,CT,RB*)
Rattlesnake Creek	by specific arrangement (STW,CT,RB,OC*)

[1] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.

WATERWAY	PREFERRED WORK PERIOD [1]
Other Middle Fork Willamette River tributaries (Confluence with the Coast Fork Willamette to Dexter Dam)	June 1 – October 31 (CT,RB*)
Middle Fork Willamette River Basin (Dexter Dam to Hills Creek Dam)	by specific arrangement (CHS,CT,RB,OC*)
North Fork Middle Fork Willamette River	July 1 – August 31 (CHS, CT,RB*)
Salmon Creek	July 1 – August 31 (CHS, CT,RB*)
Salt Creek	July 1 – August 31 (CHS, CT,RB, OC*)
Middle Fork Willamette River (above Hills Creek Dam)	July 1 - August 15 (CHS,BUT,CT,RB*)
Coast Fork Willamette River Basin	
Coast Fork Willamette River (Confluence with the Middle Fork Willamette to Cottage Grove Dam)	by specific arrangement (CHS,RB,OC*)
Coast Fork Willamette River (above Cottage Grove Dam)	May 15 – November 30 (CT*)
Row River (below Dorena Dam)	June 1 - October 31(CHS,CT,RB*)
Row River (above Dorena Dam)	May 15 – November 30 (CT*)

Southwest Region

Umpqua Watershed District

Roseburg Office - (541) 440-3353

Pacific	
Umpqua River	
Umpqua River Estuary & Smith Est.	November 1 –January 31 (MAR,SHL,CHS,CHF,CO,STW,STS,,CT*)
Umpqua River (Scottsburg and above)	July 1 - August 31(CHS,CHF,CO,STW,STS,CT*)
Umpqua River Tribs.	July 1 - September 15 (CHF,CO,STW,CT*)
North Umpqua	
North Umpqua River (below Soda Springs Dam)	by specific arrangement (CHF,CHS,CO,STW,STS,CT*)
Tribs. North Umpqua (below Soda Springs)	July 1 - September 15 (CHS,CO,STW,STS,CT*)
North Umpqua River (above Soda Springs Dam)	June 15 - October 15 (RB,BT,BR*)
South Umpqua	
South Umpqua River	July 1 - August 31(CHF,CHS,CO,STW,CT*)
South Umpqua Tribs.	July 1 - September 15 (CHF,CO,STW,CT*)

Charleston Office - (541) 888-5515

Pacific	
Coos	
Coos Bay Estuary and River (to Millicoma R./S. Coos R. confluence)	October 1 - February 15 (MAR,SHL,JUV,CHF,CO,STW,CT *)
Millicoma River, S. Coos R. and tribs.	July 1 – September 15 (CHF,CO,STW,CT,MD*)
Coquille	
Coquille River Estuary (Mouth to Bear Creek)	October 1 – February15 (MAR,SHL,JUV,CHF,CO,STW,CT *)
Coquille River and tribs. (Bear Creek and above)	July 1 - September 15 (CHF,CO,STW,CT*)
Other Coastal Tributaries	July 1- September 15 (CHF,CO,STW,CT*)
Coastal Lakes	July 1 – September 15 (CO,STW,CT*)
Coastal Lake Tributaries	July 1 - September 15 (CO,STW,CT*)

[1] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.

WATERWAY	PREFERRED WORK PERIOD [1]
Rogue Watershed District	
Gold Beach Field Office – (541) 247-7605	
Pacific	
New	
New River	October 1- May 31 (JUV CHF*)
New River Tributaries	July 15 - September 30 (CO,STW,CT*)
Floras Creek Estuary	October 1- May 31 (JUV CHF*)
Floras Creek (above Hwy 101 bridge)	July 15 - September 30 (CHF,CO,STW,CT*)
Sixes	
Sixes River Estuary	October 1- May 31 (JUV CHF*)
Sixes River (above Hwy 101 bridge)	July 15 - September 30 (CHF,CO,STW,CT*)
Elk	
Elk River Estuary	October 1- May 31 (JUV CHF*)
Elk River (above Hwy 101 bridge)	July 15 - September 30 (CHF,CO,STW,CT*)
Euchre/Coastal Tributaries	
Euchre Creek Estuary	November 1 - May 31 (JUV CHF*)
Euchre Creek (above County bridge)	July 15 - September 30 (CHF,CO,STW,CT*)
Hubbard Cr., Brush Cr.	July 15 - September 30 (CO,STW,CT*)
Mussel Cr.	July 15 - October 31 (STW,CT*)
Rogue	
Rogue River Estuary	October 1 - May 31 (JUV CHF*)
Rogue River (Elephant Rock to Marial)	May 1 - September 30 (CHF*)
Rogue River Tributaries (below Marial)	July 15 - September 30 (CHF,CO,STW,CT*)
Hunter	
Hunter Creek Estuary	November 1 - May 31 (JUV CHF*)
Hunter Creek (above County bridge)	July 15 - September 30 (CHF,CO,STW,CT*)
Pistol	
Pistol River Estuary	November 1 - May 31 (JUV CHF*)
Pistol River (above County bridge)	July 15 - September 30 (CHF,CO,STW,CT*)
Chetco/Coastal Tributaries	
Chetco River Estuary	October 1 - May 31 (JUV CHF*)
Chetco River (above Tide Rock)	July 15 - September 30 (CHF,CO,STW,CT*)
Meyers Cr., Thomas Cr., Whalehead Cr.	July 15 - October 31 (STW,CT*)
Winchuck	
Winchuck River Estuary	October 1 - May 31 (JUV CHF*)
Winchuck River (above South Fork)	July 15 - September 30 (CHF,CO,STW,CT*)
Other Coastal Tributaries	July 15 - October 31 (CT*)
Central Point Office (541) 826-8774	
Rogue	
Rogue River (Marial to William Jess Dam)	June 15 - August 31 (CHS,STW*)
Illinois River	June 15 - September 15 (CHF,STW*)
Applegate River	July 1 - September 15 (CHF,STW*)
Other Rogue River Tributaries (above Marial).	June 15 - September 15 (CHS,STW*)
Rogue River (above William Jess Dam)	June 15 - September 15 (BT,CT*)

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WATERWAY	PREFERRED WORK PERIOD
High Desert Region	
Deschutes Watershed District	
The Dalles Office - (541) 296-4628	
Columbia	
Columbia River (Within District Bonneville to John Day Dam)	November 15 - March 15 (CHF,CHS,SS,CO,STW,STS*)
Columbia River Tributaries	July 15 - September 30 (STW,CO,RB*)
Fifteenmile Creek	July 15 - October 31 (STW,RB*)
Hood River	
Hood River	July 15 - August 31 (CHF,CHS,CO,STS,STW*)
East Fork Hood River & Tribs.	July 15 – August 31 (CHF,CO,STS,STW*)
Middle Fork Hood River & Tribs.	July 15 – August 15 (STW,CHS,BUT*)
West Fork Hood River & Tribs.	July 15 – August 15 (CHS,STS,STW*)
Deschutes	
Deschutes River (below Pelton Dam)	February 1 - March 15 (CHF,STS,RB*)
White River	July 1 - October 31 (RB*)
Buckhollow Cr.	July 1 - October 31 (STS,RB*)
Bakeoven Cr.	July 1 - October 31 (STS,RB*)
Trout Cr.	July 1 - October 31 (STS,RB*)
Bend Office - (541) 388-6363	
Deschutes	
Metolius	
Metolius River	by specific arrangement (K,RB,BR,BUT*)
Spring Creek	by specific arrangement(K,RB*,BUT)
Lake Creek	by specific arrangement (K,RB)
Deschutes River (Pelton Dam through Lake Billy Chinook)	July 1 - September 30 (RB,BR*)
Crooked River	
Crooked River (below Prineville Dam)	July 1 - October 31 (RT*)
Prineville Reservoir	July 1 - October 31 (RT*)
Crooked River (above Prineville Dam)	July 1 - October 31 (RT*)
N.Fk. Crooked River (above Big Summit Prairie)	July 1 - September 30 (RT*)
Deschutes River (Lake Billy Chinook to Bend)	July 1 - September 30 (RB,BR,BUT,K*)
Whycus Creek	July 1 - October 15 (RB,BR,BUT*)
Tumalo	July 1 - October 15 (RB,BR*)
Deschutes River (Bend-North Canal Dam to Benham Falls)	July 1 - October 15 (RB,BR*)
Deschutes River (Benham Falls to Wickiup Dam)	July 1 - October 15 (RB,BR*)
Little Deschutes River	July 1 - October 15 (RB,BR*)
Fall River	July 1 - October 15 (RB,BR*)
Deschutes River(Wickiup Reservoir to Crane Prairie Dam)	July 1 - August 31 (RB,BR,K *)
Deschutes River (Crane Prairie Reservoir to Little Lava Lake)	July 1 - August 31 (RB,BT,K*)
Odell/Davis Lake and Tributaries	by specific arrangement (K,RB,BUT*)
Klamath Watershed District	
Klamath Falls Office - (541) 883-5732	
Klamath	
Klamath River (below Keno)	July 1 - September 30 (RB*,SUSP,RB,RT)
Cottonwood Creek	July 1 – September 30 (STW*)
Jenny Creek	July 1 – January 31 (SCRT,JCS*)
Klamath River (above Keno)	July 1 – January 31 (SNS,BCHUB,RT*)
Lost River above Bonanza	July 1 – January 31 (RT,SNS
Lost River below Bonanza	July 1 - March 31 (RT*)
Williamson River	August 1 - September 3(BT,BR,RT,SNS,LRS,KLS*)

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WATERWAY	PREFERRED WORK PERIOD [1]
Klamath River (above Keno)	July 1 – January 31 (SNS,BCHUB,RT*)
Lost River above Bonanza	July 1 – January 31 (RT,SNS*)
Lost River below Bonanza	July 1 - March 31 (RT*)
Williamson River	August 1 - September 30 (BT,BR,RT,SNS,LRS,KLS*)
Sprague River	August 1 - September 30 (BUT,LRS,SNS,RT,BT,BR *)
Sycan River	August 1 - September 30 (RT,BT,BR,BUT,LRS,SNS*)
Wood River	August 1 - September 30 (RT,BR,BUT,SNS*)
Sevenmile Creek	August 1 - September 30 (RT,BR*)
Klamath Lake and Agency Lake	July 1 - January 31 (RT,LRS,SNS,BCHUB*)
Silver Lake tributaries	July 15 - September 30 (RT,BT*)
Summer Lake and tributaries	July 15 - September 30 (TCHUB,RT *)
Chewaucan River	July 15 - September 30 (RT*)
Goose Lake tributaries	July 15 - September 30 (GRT,GLAM,SSUC,GCB,PRCH,PSCL,MSUC*)
Warner Valley tributaries	July 15 - September 30 (WSUC,FD,RT*)

Malheur Watershed District

Hines Office - (541) 573-6582

Columbia	
Snake	
Snake River (Malheur County)	Open
Malheur	
Malheur River (below Namorf Dam)	Open
Willow Cr. (below Malheur Res.)	Open
Willow Cr. (above Malheur Res.)	October 1 - March 31 (RB,RT*)
Cottonwood, Cr., Squaw Cr	October 1 - March 31 (RB,RT*)
Other Tributaries	October 1 - March 31 (RB,RT*)
Malheur River (Namorf Dam to Wolf Creek)	November 1 - March 31 (RT*)
North Fork Malheur (mouth to Beulah Res.)	November 1 - March 31 (RT,RB*)
North Fork Malheur (above Beulah Res.)	July 1 - August 31 (BUT,RT,BT*)
South Fork Malheur	October 1 - March 31 (RT*)
Malheur River (Including Wolf Creek and above)	July 1 - August 31 (BUT,RT,BT*)
Owyhee River	
Owyhee River (below dam)	November 1 - March 31 (RB,BT*)
Owyhee River (above dam)	October 1 - March 31 (RB,RT*)
Succor Creek	October 1 - March 31 (RT*)
Silvies River (above 5mi dam)	October 1 - March 31 (RT,*)
Silver Creek (above Hwy 45)	October 1 - March 31 (RT*)
Donner Blitzen River (Steen Mtns)	October 1 - March 31 (RT*)
Alvord Basin	October 1 - March 31 (LCT,AC*)
Catlow Valley tributaries	October 1 - March 31 (LCT,CTC,RT*)
Trout Creek Mountains streams	October 1 - March 31 (LCT,AC,RB,CT*)
Quinn River	October 1 - March 31 (LCT,RB,CT*)

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WATERWAY	PREFERRED WORK PERIOD [1]
Northeast Region	
John Day Watershed District	
John Day Office - (541) 575-1167	
Columbia River	
Lower John Day	
John Day River (below John Day)	July 15 - August 31 (STS,RT*)
Rock Creek	
Rock Creek (Gilliam Co.)	July 15 - September 30 (STS,RT*)
North Fork John Day	
North Fork John Day River (below U.S. 395)	July 15 - August 31 (STS,RT*)
Middle Fork John Day	
Middle Fork John Day River (below US 395)	July 15 - August 31 (STS,RT*)
Middle Fork John Day River (above US 395)	July 15 - August 15 (CHS,STS,RT,BUT*)
North Fork John Day River (above U.S. 395)	July 15 - August 15 (CHS,STS,BUT*)
Upper John Day	
South Fork John Day River	
South Fork John Day River	July 15 - August 31 (STS,RT*)
John Day River (above John Day)	July 15 - August 15 (CHS,STS,BUT,RT,CT*)
Canyon Creek	July 15 - August 31 (STS,RB,CT*)
Pendleton Office - (541) 276-2344	
Columbia	
Columbia River (John Day Dam upstream)	December 1 – March 31 (CHF,CHS,CO,STS*)
Willow Creek	July 1 - December 31 (RT, STS*)
Umatilla	
Umatilla River (below Cayuse)	July 15 - September 30 (CHF,CHS,CO,STS,RT, BUT*)
Butter Creek	July 1 - December 31 (RT*)
Birch Creek	July 1 - October 31 (STS,RT*)
McKay Creek	
McKay Creek (below reservoir)	December 1 - March 31 (CHF,CHS,CO,STS,RT,BUT*)
McKay Creek (above reservoir)	July 1 - December 31 (RT*)
Wildhorse Creek	July 1 - October 31 (CHF,CHS,CO,STS,RT*)
Umatilla River (above Cayuse)	July 1 - August 15 (CHS,CHF,STS,RT,CO,BUT,WF*)
Meacham Creek	
Meacham Creek (below north fork)	July 1 - August 15 (CHS,STS,RT,BUT, WF*)
Meacham Creek (above north fork)	July 1 - October 31 (STS,RT,BUT,WF*)
Cold Spring Creek	June 1 - December 31
Walla Walla	
Walla Walla River (below forks)	July 1 - September 30 (CHS,STS,RT,BUT,WF*)
Pine Creek	July 1 - October 31 (STS,RT*)
Little Walla Walla Distributary System	
Little Walla Walla (above Ferndale Rd)	December 1 – March 31(STS,RT,BUT*)
Little Walla Walla (below Ferndale Rd)	July 1 - October 31 (STS,RT,BUT*)

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WATERWAY	PREFERRED WORK PERIOD [1]
Mill Creek	July 1 - August 15 (CHS,STS,RT,BUT,WF*)
Cottonwood Creek	July 1 - October 31 (STS,RT*)
Birch Creek	July 1 - October 31 (STS,RT*)
Couse Creek	July 1 - October 31 (STS,RT*)
South Fork Walla Walla River	July 1 - August 15 (CHS,STS,RT,BUT,WF*)
North Fork Walla Walla River	
NF Walla Walla River (below Little Meadows Cyn)	July 15 - September 30 (STS,RT,BUT,WF)
NF Walla Walla River (above Little Meadows Cyn)	July 1 - August 31 (STS,RT,BUT,WF)

Grande Ronde Watershed District

Enterprise Office - (541) 426-3279

Columbia	
Snake River (state line to Hells Canyon Dam)	July 1 - October 15 (CHF,CHS,SS,STS*)
Grande RondeGrande Ronde River (below Wallowa River)	July 1 - September 15 (CHF,STS*)
Wenaha River	July 1 - August 15 (CHS,STS,BUT*)
Joseph Creek	July 1 - March 31 (STS*)
Wallowa River	July 15 - August 15 (CHS,STS,RB,BT,BUT *)
Imnaha River (above Big Sheep Creek)	July 15 - August 15 (CHS,STS,BUT*)
Imnaha River (below Big Sheep Creek)	July 1 – October 15 (CHF,STS*)

La Grande Office - (541) 963-2138

Columbia	
Snake	
Grande Ronde	
Grande Ronde River (Wallowa River to Highway 244 Bridge)	July 1 - October 15 (CHS,STS,RB,BUT*)
Minam River	July 1 – August 15 (CHS,STS,RB,BUT*)
Lookingglass Creek	July 1 - August 15 (CHS,STS,RB,BUT*)
Catherine Creek	
Catherine Creek (to, and including Little Creek)	July 1 - October 15 (CHS,STS,RB,BUT*)
Catherine Creek (above Little Creek)	July 1 – August 15 (CHS,STS,RB,BUT*
Grande Ronde River (above highway 244 bridge)	July 1 - July 31 (CHS,STS,RB,BUT*)
Snake River Reservoir	July 1 - November 30 (WW*)
Snake River Reservoir Tributaries	July 1 - October 31 (RB*)
Burnt River	July 1 - October 31 (RB,BT*)
Pine Creek	July 1 – August 31 (RB,BUT *)
Powder River (mouth to Phillips Reservoir)	July 1 - October 31 (RB*)
Anthony Creek	July 1 – August 31 (RB,BUT*)
North Powder R. (above Dutch Flat Cr.)	July 1 – August 31 (RB,BUT*)
Wolf Creek (above Wolf Creek Res.)	July 1 – August 31 (RB,BUT*)
Big Muddy Creek (above Foothill Rd.)	July 1 – August 31 (RB,BUT*)
Pine Creek (above North Fork Pine Cr.)	July 1 – August 31 (RB,BUT*)
Salmon Creek (above Pocahontas Road)	July 1 – August 31 (RB,BUT*)
Powder River (above Phillips Reservoir)	July 1 – August 31 (RB,BUT*)
Deer Creek (above Phillips Reservoir)	July 1 – August 31 (RB,BUT*)

[1] Work period is established for named stream, all upstream tributaries, and associated lakes within the watershed unless otherwise indicated.

*Coded fish species defined below provide the primary basis for timing guidelines. The species list should be considered general information and is not necessarily comprehensive nor accurate.

AC - Alford chub
BCHUB – blue chub
BR - brown trout
BT - brook trout
BUT - bull trout
CR – crappie
CHF - Chinook salmon, fall
CHR - Chinook salmon, summer
CHS - Chinook salmon, spring
CO - coho salmon
CS - chum salmon
CT - cutthroat trout (includes sea run)
CTC - Catlow tui chub
GCB - goose lake chub
FD – Foskett speckled dace
GLAM - Goose Lake lamprey
GSUC - Goose Lake sucker
JCRT – Jenny Creek red band trout
JCS – Jenny Creek sucker
JUV - juvenile salmonids
K – kokanee
KLS – Klamath largescale sucker
LCT - Lahontan cutthroat trout
LRS – Lost River sucker
MAR - various marine species of fish
MD – Millicoma dace
MMS - Malheur mottled sculpin
MSUC – Modoc sucker
OC – Oregon sucker
PRCH - pit roach
PSCL - pit sculpin
RB - rainbow trout
RT - red band trout
SHL - various marine shell fish
SNS shortnose sucker
SS - sockeye salmon
SSUC – Sacramento sucker
STS - steelhead summer
STW - steelhead winter
SUSP – sucker species
TCHUB – tui chub
WF – mountain white fish
WSUC – Warner sucker
WW - various warm water game fish

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Attachment 2
Waterbodies to Be Crossed Using the Open-Cut, Flume, Dam-and-Pump, or HDD Methods

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
1.0	S99CL001	Perennial	Adairs Slough	Lower Columbia	Method 2 - HDD	Minor	Co	0	November 1- February 28
1.5	S5BCL074	Perennial	Vera Creek	Lower Columbia	Method 1 - Flume	Minor	Co	0.49	November 1- February 28
2.9	S99CL067	Perennial	Lewis and Clark River	Lower Columbia	Method 2 - HDD	Minor	Co	0.16	November 1- February 28
4.1	S5BCL059	Perennial	Tributary of Barrett Slough	Lower Columbia	Method 1 - Flume	Minor	Co	0.1	November 1- February 28
4.2	S5BCL062	Ephemeral	Tributary of Barrett Slough	Lower Columbia	Method 3 - Open cut	Minor	Co	0.12	November 1- February 28
4.2	S5BCL063	Intermittent	Tributary of Barrett Slough	Lower Columbia	Method 3 - Open cut	Minor	Co	0.06	November 1- February 28
4.4	S5BCL064	Perennial	Barrett Slough	Lower Columbia	Method 1 - Flume	Minor	Co	0	November 1- February 28
4.5	S5BCL066	Intermittent	Tributary of Barrett Slough	Lower Columbia	Method 3 - Open cut	Minor	Co	0.11	November 1- February 28
4.7	S5BCL068	Intermittent	Tributary of Green Slough	Lower Columbia	Method 3 - Open cut	Minor	Co	0.3	November 1- February 28
4.8	S5BCL069	Intermittent	Tributary of Green Slough	Lower Columbia	Method 3 - Open cut	Minor	Co	0.39	November 1- February 28
5.0	S5BCL071	Intermittent	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	FaCh	0.23	November 1- February 28
5.2	S5BCL072	Perennial	Tributary of Lewis and Clark River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	0.09	July 15- Sept. 15
5.7	S99CL064	Perennial	Lewis and Clark River	Lower Columbia	Method 2 - Method 2 - HDD	Major	Co, FaCh	0	July 15- Sept. 15
5.9	S38CL003	Proxy Data	Tributary of Lewis and Clark River	Lower Columbia	TBD	Minor	Co	0.41	November 1- February 28
6.8	S5BCL075	Ephemeral	Tributary of Johnson Slough	Lower Columbia	Method 3 - Open cut	Minor			July 1 - Sept. 15
7.9	S1BCL001	Perennial	Heckard Creek	Lower Columbia	Method 1 - Flume	Intermediate	Co	0.02	July 1 - Sept. 15
8.6	S1BCL002	Intermittent	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	Co ,FaCh	1.17	July 1 - Sept. 15
8.8	S1BCL018	Perennial	Tributary of Lewis and Clark River	Lower Columbia	Method 1 - Flume	Intermediate	Co, FaCh	1.29	July 1 - Sept. 15
9.1	S1BCL003	Intermittent	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	0.86	July 1 - Sept. 15
9.3	S1BCL004	Intermittent	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	0.82	July 1 - Sept. 15
9.7	S1BCL005	Intermittent	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	0.97	July 1 - Sept. 15
9.7	S1BCL006	Ephemeral	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	0.96	July 1 - Sept. 15
9.9	S1BCL007	Intermittent	Tributary of Lewis and Clark River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	0.97	July 1 - Sept. 15
10.0	S1BCL008	Perennial	Tributary of Lewis and Clark River	Lower Columbia	Method 1 - Flume	Intermediate	Co, FaCh	0.98	July 1 - Sept. 15
11.0	S99CL034	Proxy Data	Lewis and Clark River	Lower Columbia	TBD	Minor	Co, FaCh	0.08	July 1 - Sept. 15
12.8	S1BCL016	Perennial	Tributary of Speelyai Creek	Lower Columbia	Method 1 - Flume	Minor	Co	1.03	July 1 - Sept. 15
13.8	S5BCL040	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.02	July 1 - Sept. 15
13.8	S5BCL041	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.03	July 1 - Sept. 15
13.9	S5BCL042	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	2.05	July 15- Sept. 30
13.9	S5BCL043	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	2.08	July 15- Sept. 30

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
14.1	S5BCL045	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.15	July 15- Sept. 30
14.2	S5BCL044	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.16	July 15- Sept. 30
14.9	S5BCL038	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	2.28	July 15- Sept. 30
15.3	S5BCL035	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	2.09	July 15- Sept. 30
15.6	S5BCL030	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.11	July 15- Sept. 30
15.6	S5BCL034	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.08	July 15- Sept. 30
15.8	S5BCL031	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	2.25	July 15- Sept. 30
16.1	S99CL024	Proxy Data	Tributary of Lewis and Clark River	Lower Columbia	TBD	Minor	Co, FaCh	0.1	July 15- Sept. 15
16.1			Bayney Creek	Lower Columbia					
16.7	S5BCL032	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	2.98	July 15- Sept. 30
17.3	S5BCL077	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	3.61	July 15- Sept. 30
17.8	S5BCL079	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	4.09	July 15- Sept. 30
17.9	S5BCL078	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	4.05	July 15- Sept. 30
17.9	S5BCL080	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	4.2	July 15- Sept. 30
18.4	S5BCL076	Perennial	Tributary of Rock Creek	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	4.64	July 15- Sept. 30
18.5	S1BCL009	Perennial	Rock Creek	Lower Columbia	Method 1 - Flume	Intermediate	Co, FaCh	4.78	July 15- Sept. 30
18.8	S1BCL010	Intermittent	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	5.08	July 15- Sept. 30
19.0	S1BCL011	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	5.25	July 15- Sept. 30
19.1	S1BCL012	Intermittent	Unnamed	Lower Columbia	Method 1 - Flume	Minor		2.93	July 15- Sept. 30
19.3	S1BCL014	Perennial	Osgood Creek	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	5.55	July 15- Sept. 30
19.6	S2BCL013A	Perennial	Tributary of Osgood Creek	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	5.79	July 15- Sept. 30
20.1	S2BCL013B	Perennial	Fox Creek	Lower Columbia	Method 1 - Flume	Intermediate	Co, FaCh	6.1	July 15- Sept. 30
21.4	S38CL013	Perennial	South Fork Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	7.16	July 15- Sept. 30
21.8	S5BCL058	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Intermediate	Co, FaCh	7.58	July 15- Sept. 30
22.1	S5BCL049	Perennial	Tributary of Youngs River	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	7.85	July 15- Sept. 30
22.2	S5BCL048	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	7.92	July 15- Sept. 30
22.5	S6BCL020	Intermittent	Tributary of Fall Creek	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.77	July 15- Sept. 30
22.6	S6BCL017	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.51	July 15- Sept. 30
22.6	S6BCL018	Ephemeral	Tributary of Fall Creek	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.62	July 15- Sept. 30
22.8	S6BCL015	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.23	July 15- Sept. 30

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
22.8	S6BCL016	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.2	July 15- Sept. 30
23.0	S6BCL019	Perennial	Tributary of Fall Creek	Lower Columbia	Method 1 - Flume	Intermediate	Co, FaCh	8.66	July 15- Sept. 30
23.4	S38CL014	Perennial	Fall Creek	Lower Columbia	Method 1 - Flume	Minor	Co, FaCh	9.11	July 15- Sept. 30
24.3	S5BCL016	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co, FaCh	2.36	July 1- Aug. 31
24.4	S5BCL018	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co, FaCh	2.32	July 1- Aug. 31
24.4	S5BCL017	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co, FaCh	2.34	July 1- Aug. 31
24.8	S2BCL001	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co, FaCh	2.09	July 1- Aug. 31
24.8	S2BCL002	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Intermediate	Co, FaCh	2.08	July 1- Aug. 31
25.1	S2BCL003	Ephemeral	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co, FaCh	1.97	July 1- Aug. 31
25.2	S2BCL005	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Intermediate	Co, FaCh	1.96	July 1- Aug. 31
25.2	S2BCL004	Intermittent	Tributary of Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co, FaCh	1.96	July 1- Aug. 31
25.3	S2BCL007	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 3 -Method 3 - Open cut	Minor	Co, FaCh	1.95	July 1- Aug. 31
25.4	S2BCL008A	Perennial	Tributary of Fishhawk Creek	Nehalem	Method 1 - Flume	Intermediate	Co, FaCh	1.95	July 1- Aug. 31
25.7	S2BCL009	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Intermediate	Co	4.29	July 1- Aug. 31
25.7	S38CL015	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	4.27	July 1- Aug. 31
25.7	S2BCL010	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	4.27	July 1- Aug. 31
25.9	S2BCL012	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	4.19	July 1- Aug. 31
26.3	S5BCL019	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	3.87	July 1- Aug. 31
26.5	S5BCL029	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	3.68	July 1- Aug. 31
26.6	S5BCL027	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	3.63	July 1- Aug. 31
26.6	S5BCL028	Ephemeral	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	3.63	July 1- Aug. 31
26.8	S5BCL023	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	3.4	July 1- Aug. 31
26.8	S5BCL025	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	3.41	July 1- Aug. 31
27.0	S5BCL022	Ephemeral	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	3.27	July 1- Aug. 31
27.2	S5BCL021	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	3.05	July 1- Aug. 31
27.3	S5BCL020	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	2.97	July 1- Aug. 31
27.4	S5BCL015	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	2.89	July 1- Aug. 31
27.6	S5BCL014	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	2.68	July 1- Aug. 31
27.8	S5BCL012	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	2.55	July 1- Aug. 31
27.8	S5BCL013	Intermittent	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	2.56	July 1- Aug. 31

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
27.9	S5BCL011	Ephemeral	Tributary of Little Fishhawk Creek	Nehalem	Method 3 - Open cut	Minor	Co	2.46	July 1- Aug. 31
28.1	S5BCL010	Perennial	Tributary of Little Fishhawk Creek	Nehalem	Method 1 - Flume	Minor	Co	2.35	July 1- Aug. 31
28.4	S5BCL007	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	1.24	July 1- Sept. 15
28.5	S5BCL004	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	1.13	July 1- Sept. 15
28.5	S5BCL005	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	1.19	July 1- Sept. 15
29.0	S5BCL001	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.79	July 1- Sept. 15
29.0	S5BCL002	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.81	July 1- Sept. 15
29.4	S6BCL011	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.45	July 15- Sept. 30
29.4	S6BCL013	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.28	July 15- Sept. 30
29.4	S6BCL014	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.29	July 15- Sept. 30
29.5	S6BCL010	Ephemeral	Tributary of Youngs River	Lower Columbia	Method 3 - Open cut	Minor	Co, FaCh	8.49	July 15- Sept. 30
29.9	S6BCL008	Ephemeral	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.8	July 1- Sept. 15
30.2	S6BCL007	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.81	July 1- Sept. 15
30.4	S6BCL006	Perennial	Tributary of East Humbug Creek	Nehalem	Method 1 - Flume	Minor	Co	0.79	July 1- Sept. 15
30.9	S2BCL021	Ephemeral	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.72	July 1- Sept. 15
31.4	S2BCL008B	Perennial	Alder Creek	Nehalem	Method 1 - Flume	Minor	Co	0	July 1- Sept. 15
31.6	S6BCL005	Perennial	Tributary of East Humbug Creek	Nehalem	Method 1 - Flume	Minor	Co	0.78	July 1- Sept. 15
32.0	S3BCL001	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.69	July 1- Aug. 31
32.0	S3BCL002	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.68	July 1- Aug. 31
32.1	S3BCL003	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.67	July 1- Aug. 31
32.1	S3BCL004	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.66	July 1- Aug. 31
32.3	S3BCL005	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.67	July 1- Aug. 31
32.3	S3BCL006	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.67	July 1- Aug. 31
32.4	S3BCL007	Intermittent	Tributary of Nehalem River	Nehalem	Method 3 - Open cut	Minor	Co, SpCh, FaCh	0.68	July 1- Aug. 31
33.5	S99CL108	Perennial	Nehalem River	Nehalem	Method 2 - Method 2 - HDD	Major	Co, SpCh, FaCh	0	July 1- Aug. 31

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
33.5		Perennial	Nehalem River	Nehalem					
34.4	S5BCL046	Perennial	Tributary of Nehalem River	Nehalem	Method 1 - Flume	Minor	Co, SpCh, FaCh	1.06	July 1- Aug. 31
35.5	S6BCL026	Perennial	Osweg Creek	Nehalem	Method 1 - Flume	Intermediate	Co, SpCh, FaCh	0.67	July 1- Aug. 31
37.5	S38CL011	Perennial	North Fork Quartz Creek	Nehalem	Method 1 - Flume	Minor	Co	0.47	July 1- Aug. 31
37.5	S8BCL009	Perennial	Tributary of South Fork Rock Creek	Nehalem	Method 1 - Flume	Intermediate	Co	0	July 1- Aug. 31
38.5	S8BCL005	Perennial	Rock Creek	Nehalem	Method 2 - HDD	Intermediate	Co	0	July 1- Aug. 31
39.6	S1BCL029	Intermittent	Tributary of Military Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.28	July 1- Aug. 31
39.8	S1BCL027	Intermittent	Tributary of Military Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.17	July 1- Aug. 31
39.8	S1BCL028	Intermittent	Tributary of Military Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.18	July 1- Aug. 31
42.6	S1BCL020	Perennial	Tributary of South Fork Rock Creek	Nehalem	Method 1 - Flume	Minor	Co	0.03	July 1- Aug. 31
43.1	S1BCL021	Perennial	South Fork Rock Creek	Nehalem	Method 2 - HDD	Intermediate	Co	0	July 1- Aug. 31
43.3	S1BCL022	Perennial	Bear Creek	Nehalem	Method 2 - HDD	Intermediate	Co	0	July 1- Aug. 31
43.5	S1BCL023	Intermittent	Tributary of Bear Creek	Nehalem	Method 2 - HDD	Minor	Co	0.04	July 1- Aug. 31
43.7	S1BCL024	Perennial	Tributary of Bear Creek	Nehalem	Method 1 - Flume	Minor	Co	0.09	July 1- Aug. 31
43.9	S1BCL025	Intermittent	Tributary of Bear Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.12	July 1- Aug. 31
44.0	S1BCL026	Intermittent	Tributary of Bear Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.11	July 1- Aug. 31
44.2	S1BTI001	Perennial	Bear Creek	Nehalem	Method 1 - Flume	Minor	Co	0.18	July 1- Aug. 31
44.3	S1BTI002	Intermittent	Tributary of Bear Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.27	July 1- Aug. 31
44.8	S6BCL004	Intermittent	Tributary of East Humbug Creek	Nehalem	Method 3 - Open cut	Minor	Co	0.59	July 1- Sept. 15
45.1	S1BTI003	Ephemeral	Tributary of Wolf Creek	Nehalem	Method 3 - Open cut	Minor	Co, SpCh	2.41	July 1- Aug. 31
47.6	S99CO001	Perennial	North Fork Wolf Creek	Nehalem	Method 1 - Flume	Proxy Data	Co, SpCh, St	0.00	July 1 - August 31
48.3	S1BCO000	Perennial	Tributary of North Fork Wolf Creek	Nehalem	Method 1 - Flume	Minor	TBD	0.64	July 1 - August 31
50.5	S3BCO012	Perennial	Clear Creek	Nehalem	Method 1 - Flume	Intermediate	Co	0.03	July 1 - August 31
53.6	S3BCO002	Perennial	Fall Creek	Nehalem	Method 1 - Flume	Minor	TBD	2.28	July 1 - August 31
55.7	S3BCO107	Perennial	Cedar Creek	Nehalem	Method 1 - Flume	Minor	Co	0.01	July 1 - August 31
55.9	S3BCO106	Perennial	Tributary of Cedar Creek	Nehalem	Method 1 - Flume	Minor	not confirmed	0.21	July 1 - August 31
57.7	S3BCO100	Perennial	Tributary of Rock Creek	Nehalem	Method 2 - HDD	Minor	not confirmed	0.01	July 1 - August 31
57.7	S3BCO101	Perennial	Rock Creek	Nehalem	Method 2 - HDD	Intermediate	Co, SpCh, St	0.00	July 1 - August 31
63.8	S3BCO014	Perennial	Nehalem River	Nehalem	Method 2 - HDD	Intermediate	Co, SpCh, St	0.00	July 1 - August 31

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
66.3	S3BCO103	Intermittent	Tributary of Oak Ranch Creek	Nehalem	Method 3 - Open cut	Minor	not confirmed	0.94	July 1 - August 31
66.3		Perennial	Oak Ranch Creek	Nehalem					
69.0	S99CO004	Intermittent	Tributary of Oak Ranch Creek	Nehalem	Method 3 - Open cut	Proxy Data	not confirmed	0.90	July 1 - August 31
70.1	S3BCO003	Intermittent	Tributary of Clatskanie River	Lower Columbia-Clatskanie	Method 3 - Open cut	Intermediate	not confirmed	0.59	July 15-September 15
70.7	S3BCO004	Perennial	Clatskanie River	Lower Columbia-Clatskanie	Method 1 - Flume	Intermediate	Co, St	0.00	July 15-September 15
71.8	S5BCO001	Perennial	Little Clatskanie River	Lower Columbia-Clatskanie	Method 1 - Flume	Minor	Co	0.06	July 15-September 15
72.5	S3BCO008	Perennial/Intermittent	Tributary of Deer Island Slough	Lower Willamette	Method 1 - Flume	Minor	not confirmed	0.24	July 15 - August 31
72.8	S3BCO010	Perennial	Deer Island Slough	Lower Willamette	Method 1 - Flume	Intermediate	Co, St	0.02	July 15 - August 31
73.4	S1BCO004	Perennial	Apilton Creek	Lower Willamette	Method 1 - Flume	Minor	TBD	0.54	July 15 - August 31
73.5	S1BCO005	Intermittent	Tributary of Apilton Creek	Lower Willamette	Method 3 - Open cut	Minor	TBD	0.58	July 15 - August 31
74.5	S99CO009	Intermittent	Tributary of Deer Island Slough	Lower Willamette	Method 3 - Open cut	Proxy Data	not confirmed	0.15	July 15 - August 31
74.7	S99CO012	Perennial	Deer Island Slough	Lower Willamette	Method 1 - Flume	Proxy Data	Co, St	0.00	July 15 - August 31
76.0	S3BCO110	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3 - Open cut	Minor	not confirmed	0.23	July 15-September 15
76.2	S99CO013	?	Merrill Creek	Lower Columbia-Clatskanie	Method 1 - Flume	Proxy Data	TBD	0.23	July 15-September 15
78.1	S2BCO009	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3 - Open cut	Minor	not confirmed	0.38	July 15-September 15
78.2	S3BCO122	Perennial	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 1 - Flume	Minor	Co	0.20	July 15-September 15
78.8	S3BCO120	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3 - Open cut	Minor	not confirmed	0.87	July 15-September 15
78.8	S3BCO119	Intermittent	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 3 - Open cut	Minor	not confirmed	0.92	July 15-September 15
79.7	S3BCO115	Perennial	Tributary of Merrill Creek	Lower Columbia-Clatskanie	Method 1 - Flume	Minor	TBD	2.01	July 15-September 15
81.4	S99CO011	Perennial	Benham/Deer Island Slough	Lower Columbia-Clatskanie	Method 1 - Flume	Proxy Data	TBD	0.46	TBD
81.8	S3BCO123	Intermittent	Dyna Nobel Channel	Lower Columbia-Clatskanie	Method 3 - Open cut	Intermediate	TBD	0.45	TBD

ATTACHMENT 2

Waterbodies to Be Crossed Using Open-Cut, Flume, Dam-and-Pump, or HDD Methods

Milepost	Stream ID	Stream Type[a]	Water Body[b]	Hydrologic Unit Code (4th Order)	Crossing Method	Water Body Type[c]	Fish Species[d]	Miles to Salmon Habitat	Preferred Work Period
81.9	S99CO014	Perennial	Columbia River	Lower Columbia-Clatskanie	Method 2 - HDD	Major	TBD	0.00	November 1-February 28
83.3	S99CW001	Perennial	Tributary of Burris Creek	Lewis	Method 1 - Flume	Proxy	not confirmed	1.70	TBD
84.0	S99CW003	Perennial	Tributary of Burris Creek	Lewis	Method 1 - Flume	Proxy	TBD	3.21	TBD
85.1	S99CW002	Perennial	Burris Creek	Lewis	Method 1 - Flume	Proxy	TBD	0.00	TBD
85.1	S99CW006	Perennial	Tributary of Burris Creek	Lewis	Method 1 - Flume	Minor	not confirmed	0.00	TBD
85.1	S99CW007	Perennial	Tributary of Burris Creek	Lewis	Method 1 - Flume	Proxy	not confirmed	2.84	TBD
85.7	S99CW009	Perennial	Tributary of Burris Creek	Lewis	Method 1 - Flume	Proxy	not confirmed	2.39	TBD
86.1	S99CW010	Perennial	Tributary of Burris Creek	Lewis	Method 1 - Flume	Proxy	not confirmed	1.84	TBD
86.1		Perennial	Burris Creek	Lewis					

[a] As determined by field observation or the U.S. Geological Survey (USGS) 7.5-minute topographic maps. Intermittent: has surface flow for at least 3 months out of the year and has a connection to groundwater; ephemeral - has only surface flow for a portion of the year, no connection to groundwater; perennial: contains flow all year long.

[b] Waterbody names are as depicted on USGS 7.5-minute topographic maps.

[c] Stream designation includes minor, intermediate, and major waterbodies crossed by the Project. Minor waterbodies include all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing; intermediate waterbodies include all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and major waterbodies include all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

[d] Fisheries classifications within the state of Oregon are considered to be coldwater fisheries (see *Oregon LNG Bidirectional Project Resource Report 3 — Fish, Wildlife, and Vegetation* [CH2M HILL, May 2013] for more information).

Abbreviations:

Co = Coho Salmon
E = Ephemeral
FaCh = Fall Chinook Salmon
I = Intermittent
MP = Milepost
NA = Not available
NDA = No data available
P = Perennial
SpCh = Spring Chinook Salmon
St = Winter Steelhead
TBD = To be determined.

Proxy Data = These data were provided by the National Wetlands Inventory (NWI) database, the Warrington Local Wetland Inventory (LWI) database, the Pacific Northwest (PNW) Hydrography Framework, and the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database.

The data do not include certain information, such as stream type, stream width, or wetland type. Once the final Pipeline route is approved and access to these areas is secured, these data will be collected.

Data will be provided in the final submittal of environmental resource reports.

Additional Notes:

Stream ID numbers beginning in S99 are for areas with no field access and are based on aerial photo and Pacific Northwest Hydrography Network database.

Remaining data are from field surveys.

Duplicate milepost numbers occur because of rounding of mileposts to nearest tenth of a mile.

Attachment 3
Guidelines for Electrofishing Water Containing Salmonids Listed Under the Endangered Species Act

National
Marine
Fisheries
Service

Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act

June 2000

Purpose and Scope

The purpose of this document is to provide guidelines for the safe use of backpack electrofishing in waters containing salmonids listed by the National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA). It is expected that these guidelines will help improve electrofishing technique in ways which will reduce fish injury and increase electrofishing efficiency. These guidelines and sampling protocol were developed from NMFS research experience and input from specialists in the electrofishing industry and fishery researchers. This document outlines electrofishing procedures and guidelines that NMFS has determined to be necessary and advisable when working in freshwater systems where threatened or endangered salmon and steelhead may be found. As such, the guidelines provide a basis for reviewing proposed electrofishing activities submitted to NMFS in the context of ESA Section 10 permit applications as well as scientific research activities proposed for coverage under an ESA Section 4(d) rule.

These guidelines specifically address the use of backpack electrofishers for sampling juvenile or adult salmon and steelhead that are *not* in spawning condition. Electrofishing in the vicinity of adult salmonids in spawning condition and electrofishing near redds are not discussed as there is no justifiable basis for permitting these activities except in very limited situations (e.g., collecting brood stock, fish rescue, etc.). The guidelines also address sampling and fish handling protocols typically employed in electrofishing studies. While the guidelines contain many specifics, they are not intended to serve as an electrofishing manual and do not eliminate the need for good judgement in the field.

Finally, it is important to note that researchers wishing to use electrofishing in waters containing listed salmon and steelhead are not necessarily precluded from using techniques or equipment not addressed in these guidelines (e.g., boat electrofishers). However, prior to authorizing the take of listed salmonids under the ESA, NMFS will require substantial proof that such techniques/equipment are clearly necessary for a particular study and that adequate safeguards will be in place to protect threatened or endangered salmonids. Additional information regarding these guidelines or other research issues dealing with salmon and steelhead listed under the ESA can be obtained from NMFS' Protected Resources Divisions in:

Washington, Oregon, and Idaho
Leslie Schaeffer
NMFS
525 NE Oregon Street, Suite 500
Portland, Oregon 97232-2737
Phone: (503) 230-5433
FAX: (503) 230-5435
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Dan Logan
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777 Sonoma Ave., Room 325
Santa Rosa, California 95404-6515
Phone: (707) 575-6053
FAX: (707) 578-3435
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Appropriateness of Electrofishing

Backpack electrofishing for salmonids has been a principal sampling technique for decades, however, recent ESA listings underscore the need to regulate the technique and assess its risks and benefits to listed species (Nielsen 1998). With over 25 Evolutionarily Significant Units (ESUs) of threatened or endangered salmonids now identified along the U.S. West Coast, researchers can expect to encounter one or more listed species in nearly every river basin in California, Oregon, Washington, and Idaho. There are few if any non-invasive ways to collect distribution, abundance, or morpho-physiological data on salmonids in freshwater. This is reflected in the requirement that all activities that involve intentional take of juvenile salmonids for research or enhancement of an ESA listed species require an ESA Section 10 permit from NMFS. While NMFS has not precluded the use of electrofishing in all cases, researchers must present rigorous study designs and methods for handling fish prior to NMFS authorizing electrofishing to take listed salmonids under the ESA.

NMFS believes there is ample evidence that electrofishing can cause serious harm to fish and the general agency position is to encourage researchers to seek out other less invasive ways to sample listed species. Direct observation by snorkeling is one of the least invasive ways to collect information concerning abundance and distribution, although there can be both practical (e.g., poor viability) and statistical (e.g., large numbers of fish, low observation probability) constraints to direct observation. Preliminary efforts should be directed at study designs that use less invasive methods. If such methods cannot provide the quality of data required or when the benefit exceeds potential mortality risk, then electrofishing can be considered. Electrofishing used on a limited basis to calibrate direct observations (e.g., Hankin and Reeves 1988) is commonly used and methods are currently under development that increase the use of direct observation counts (e.g., bounded counts, "multiple snorkel passes") which, in many cases, will further reduce the need for electrofishing.

Electrofishing Guidelines

Training

Field supervisors and crew members must have appropriate training and experience with electrofishing techniques. Training for field supervisors can be acquired from programs such as those offered from the U. S. Fish and Wildlife Service - National Conservation Training Center (*Principles and Techniques of Electrofishing* course) where participants are presented information concerning such topics as electric circuit and field theory, safety training, and fish injury awareness and minimization. A crew leader having at least 100 hours of electrofishing experience in the field using similar equipment must train the crew. The crew leader's experience must be documented and available for confirmation; such documentation may be in the form of a logbook. The training must occur before an inexperienced crew begins any electrofishing and should be conducted in waters that do not contain ESA-listed fish. Field crew training must include the following elements:

1. A review of these guidelines and the equipment manufacturer's recommendations, including basic gear maintenance.
2. Definitions of basic terminology (e.g. galvanotaxis, narcosis, and tetany) and an explanation of how electrofishing attracts fish.
3. A demonstration of the proper use of electrofishing equipment (including an explanation of how gear can injure fish and how to recognize signs of injury) and of the role each crew member

performs.
4. A demonstration of proper fish handling, anesthetization, and resuscitation techniques.
5. A field session where new individuals actually perform each role on the electrofishing crew.

Research Coordination
Research activities should be coordinated with fishery personnel from other agencies/parties to avoid duplication of effort, oversampling small populations, and unnecessary stress on fish. Researchers should actively seek out ways to share data on threatened and endangered species so that fish samples yield as much information as possible to the research community. NMFS believes that the state fishery agencies should play a major role in coordinating salmonid research and encourages researchers to discuss their study plans with these agencies prior to approaching NMFS for an ESA permit.

Initial Site Surveys and Equipment Settings
1. In order to avoid contact with spawning adults or active redds, researchers must conduct a careful visual survey of the area to be sampled before beginning electrofishing.
2. Prior to the start of sampling at a new location, water temperature and conductivity measurements should be taken to evaluate electroshocker settings and adjustments. **No electrofishing should occur when water temperatures are above 18°C or are expected to rise above this temperature prior to concluding the electrofishing survey. In addition, studies by NMFS scientists indicate that no electrofishing should occur in California coastal basins when conductivity is above 350 µS/cm.**
3. Whenever possible, a block net should be placed below the area being sampled to capture stunned fish that may drift downstream.
4. Equipment must be in good working condition and operators should go through the manufacturer's preseason checks, adhere to all provisions, and record major maintenance work in a logbook.
5. Each electrofishing session must start with all settings (voltage, pulse width, and pulse rate) set to the **minimums** needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured, and generally not allowed to exceed conductivity-based maxima (Table 1). Only direct current (DC) or pulsed direct current (PDC) should be used.

Table 1. Guidelines for initial and maximum settings for backpack electrofishing.

	Initial settings	Maximum settings		Notes
Voltage	100 V	Conductivity (µS/cm)	Max. Voltage	In California coastal basins, settings should never exceed 400 volts. Also, no electrofishing should occur in these basins if conductivity is greater than 350 µS/cm.
		< 100	1100 V	
		100 - 300	800 V	
		> 300	400 V	
Pulse width	500 µs	5 ms		
Pulse rate	30 Hz	70 Hz		*In general*, exceeding 40 Hz will injure more fish

Electrofishing Technique

1. Sampling should begin using straight DC. Remember that the power needs to remain on until the fish is netted when using straight DC. If fish capture is unsuccessful with initial low voltage, gradually increase voltage settings with straight DC.
2. If fish capture is not successful with the use of straight DC, then set the electrofisher to lower voltages with PDC. If fish capture is unsuccessful with low voltages, increase pulse width, voltage, and pulse frequency (duration, amplitude, and frequency).
4. Electrofishing should be performed in a manner that minimizes harm to the fish. Stream segments should be sampled systematically, moving the anode continuously in a herringbone pattern (where feasible) through the water. Care should be taken when fishing in areas with high fish concentrations, structure (e.g., wood, undercut banks) and in shallow waters where most backpack electrofishing for juvenile salmonids occurs. Voltage gradients may be high when electrodes are in shallow water where boundary layers (water surface and substrate) tend to intensify the electrical field.
5. Do not electrofish in one location for an extended period (e.g., undercut banks) and regularly check block nets for immobilized fish.
6. Fish should not make contact with the anode. Remember that the zone of potential injury for fish is 0.5 m from the anode.
7. Electrofishing crews should be generally observant of the condition of the fish and change or terminate sampling when experiencing problems with fish recovery time, banding, injury, mortality, or other indications of fish stress.
8. Netters should not allow the fish to remain in the electrical field any longer than necessary by removing stunned fish from the water immediately after netting.

Sample Processing and Recordkeeping

1. Fish should be processed as soon as possible after capture to minimize stress. This may require a larger crew size.
2. All sampling procedures must have a protocol for protecting held fish. Samplers must be aware of the conditions in the containers holding fish; air pumps, water transfers, etc., should be used as necessary to maintain safe conditions. Also, large fish should be kept separate from smaller prey-sized fish to avoid predation during containment.
3. Use of an approved anesthetic can reduce fish stress and is recommended, particularly if additional handling of fish is required (e.g., length and weight measurements, scale samples, fin clips, tagging).
4. Fish should be handled properly (e.g., wetting measuring boards, not overcrowding fish in buckets, etc.).
5. Fish should be observed for general condition and injuries (e.g., increased recovery time, dark bands, apparent spinal injuries). Each fish should be completely revived before releasing at the location of capture. A plan for achieving efficient return to appropriate habitat should be developed before each sampling session. Also, every attempt should be made to process and release ESA-listed specimens first.
8. Pertinent water quality (e.g., conductivity and temperature) and sampling notes (e.g., shocker settings, fish condition/injuries/mortalities) should be recorded in a logbook to improve technique and help train new operators. *It is important to note that records of injuries or mortalities pertain to the entire electrofishing survey, including the fish sample work-up.*

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APPENDIX F6

TECHNICAL MEMORANDUM: MIGRATORY BIRDS—REGULATORY REVIEW AND MITIGATION

Migratory Birds—Regulatory Review and Mitigation

PREPARED FOR: Resource Report 3

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DATE: May 1, 2013

Introduction

Migratory birds are protected by the federal Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 United States Code [U.S.C.] 703-712). The Memorandum of Understanding between the Federal Energy Regulatory Commission and U.S. Department of the Interior United States Fish and Wildlife Service (USFWS) regarding implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" (FERC and USFWS, 2011) (MBTA MOU) provides guidance on complying with the MBTA. This technical memorandum provides regulatory background on migratory birds relative to commercial logging and Pipeline operations. It also presents recommendations for avoidance of impacts to migratory birds and for stewardship compliance with the MBTA MOU. Oregon LNG proposes to clear land, including trees on commercial timberland, within a nominal 100-foot-wide construction corridor and associated additional temporary workspaces to accommodate the Pipeline. Vegetated habitats, including commercial forests, may provide habitat for many species of migratory birds, including raptors and songbirds.

Regulatory Background

Section 703 of the MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the U.S. Department of the Interior. The MBTA has no provision for allowing unauthorized take.

The MBTA MOU specifies that both parties shall support the conservation intent of Executive Order 13186, and the migratory bird conventions, to the extent possible and practicable, by the following:

- Integrating bird conservation principles, measures, and practices into agency actions;
- Avoiding or minimizing the take of migratory birds and adverse effects on their habitat;
- Improving habitat conditions for migratory birds on lands affected by energy projects; and
- Preventing or abating pollution detrimental to migratory birds and their habitats.

While the MBTA provides no mechanism for allowing unauthorized take, the USFWS recognizes that some birds may be taken during such activities as pipeline construction, even if all reasonable measures to avoid take are implemented. The USFWS Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the USFWS Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented (Rockies Express Pipeline LLC and USFWS, 2008).

A number of court cases have dealt with the authority of the MBTA and logging operations (Lurman, 2007). In 2000, nine environmental groups, including the Center for Environmental Law, submitted a document (SEM-99-002) asserting that the Federal government was failing to enforce Section 703 of the MBTA. The submitters claimed that logging operations consistently result in violations of the MBTA, killing an enormous number of birds, or destroying their nests and eggs. The submitters assert that, despite being aware of these violations, the United States never prosecutes logging operations that violate the MBTA. The submitters specifically referred to two cases in California where migratory birds were killed. The first case involves the logging of several hundred trees by a private landowner during the nesting season of great blue herons, allegedly resulting in hundreds of crushed eggs. The second case involves a logging company's alleged intentional burning of four trees on private land, including one allegedly used by a nesting pair of osprey.

In 2003, the North American Commission for Environmental Cooperation (CEC) conducted a legal review of how the MBTA has been applied to private logging operations (CEC, 2003). The CEC determined that there has never been a prosecution of a private timber harvest operation since the MBTA was enacted in 1918. The CEC concluded the following:

- USFWS has long had an "unwritten policy relative to the MBTA that no enforcement or investigative action should be taken in incidents involving logging operations, that result in the taking of non-endangered, non-threatened migratory birds and/or their nests"
- Because of limited resources, USFWS has "concentrated its regulatory, enforcement, and scientific efforts to reducing unintentional takes of migratory birds caused by those activities where industry has created hazardous conditions which often attract migratory birds to their death (i.e., birds attracted to perching on power lines or open oil pits that appear as water ponds to overflying birds"
- "Alternative statutes and non-enforcement initiatives are more effective and efficient in protecting migratory birds [and] habitat modification *per se* is not prohibited by the MBTA. This means that establishing a violation of the MBTA due to logging activities poses more significant technical challenges than many other types of MBTA violations. Therefore, the USFWS has thus far made *bona fide* decisions to allocate enforcement resources to investigating and prosecuting other possible violations instead of those caused by logging activities. The USFWS made its resource allocation decisions in good faith and always with the objective to conserve migratory bird populations and their habitats in sufficient quantities to prevent them from becoming threatened or endangered." (CEC, 2003)

On advice of counsel, it does not appear that the MBTA imposes an affirmative duty to take specific action under the MBTA, other than to avoid taking of migratory birds. Logging associated with clearing a Pipeline corridor by itself does not trigger the need for a permit or other regulatory approval under the MBTA, as habitat destruction alone does not constitute a "take" under the MBTA (*Seattle Audubon Society v. Evans,* 952 F.2d 297 [9th Cir., 1991]; *City of Sausalito v. O'Neill*, 386 F.3d 1186 [9th Cir., 2004]). However, in the interest of being good stewards of the environment that the Pipeline will affect, it is recommended that measures be taken to avoid take.

Mitigation

Oregon LNG will take reasonable and prudent measures to avoid the taking of birds protected by the MBTA and in accordance with the MBTA MOU. These measures are in addition to those that may be imposed to protect birds protected under the Endangered Species Act, such as the northern spotted owl and marbled murrelet (see Resource Report 3, Appendix 3E).

Land clearing will take place the same year as Pipeline construction (see Resource Report 1 for a Project schedule). Clearing will take place as late as possible in the spring and early summer to avoid as much of the nesting season as possible. Oregon LNG proposed land clearing in the late summer and early fall prior to Pipeline construction. The National Marine Fisheries Service (NMFS) was concerned that such a schedule increased risk of erosion into streams, particularly salmon-bearing streams. The USFWS, in consultation with NMFS, advised Oregon LNG that the preferred schedule would be to conduct land clearing the same year as construction. The corridor would then be rehabilitated at the end of the construction season, thereby limiting and minimizing exposure and risk of soil erosion.

Assuming that vegetation clearing cannot be avoided during the entire nesting and breeding season, Oregon LNG will provide biologists to conduct a preconstruction reconnaissance of the Terminal and Pipeline corridor to identify any active migratory bird nests. If one or more active nests are identified within the construction corridor, biologists will mark the location(s) of the nest(s) in the field and on the construction plans and delay vegetation clearing around the active nest(s) until such time as the nest(s) have fledged or failed (due to natural causes). If one or more active nests are identified outside the construction corridor but nearby, the biologists will monitor the nest(s) during construction for signs of disturbance. If it appears that the monitored nest(s) are exhibiting disturbance that could lead to unintentional indirect take pursuant to the MBTA, construction should be halted temporarily until such time as the nest has fledged or failed (due to natural causes). Trees with nests may be cut during the non-nesting season. Preconstruction surveys will include an aerial survey for raptor nests in late March prior to trees leafing out.

Vegetation clearing shall not occur within 500 feet of any existing eagle, osprey, or other raptor nest locations or trees used by such birds unless a variance is granted, in writing, by USFWS. Band-tailed pigeon nesting or roosting tree(s), as well as any tree(s) near an existing great blue heron rookery, are not to be removed unless the USFWS approves it in writing. Removing trees in a designated nest patch of a northern spotted owl shall be avoided. Removing trees in a cluster of trees known to provide nesting for marbled murrelets shall be avoided.

Unintentional take, the observation that land clearing has unintentionally killed a migratory bird, shall be reported to Oregon LNG's designated environmental compliance officer within 24 hours of such an incident. The environmental compliance officer will be responsible for reporting the unintentional take to USFWS.

Oregon LNG will rehabilitate the Pipeline corridor to provide habitat for birds and other wildlife. In addition, Oregon LNG proposed extensive upland and riparian habitat mitigation in the *Applicant-Prepared Conceptual Mitigation Plan for the Oregon LNG Terminal and Oregon Pipeline Project* (CH2M HILL, 2009). The habitat mitigation proposed in the conceptual mitigation plan places an emphasis on preservation and management toward late-successional forests and riparian habitats that are in decline in the Coast Range. The combination of rehabilitation of the Pipeline corridor, long-term conservation of upland, and riparian habitats will benefit migratory birds.

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